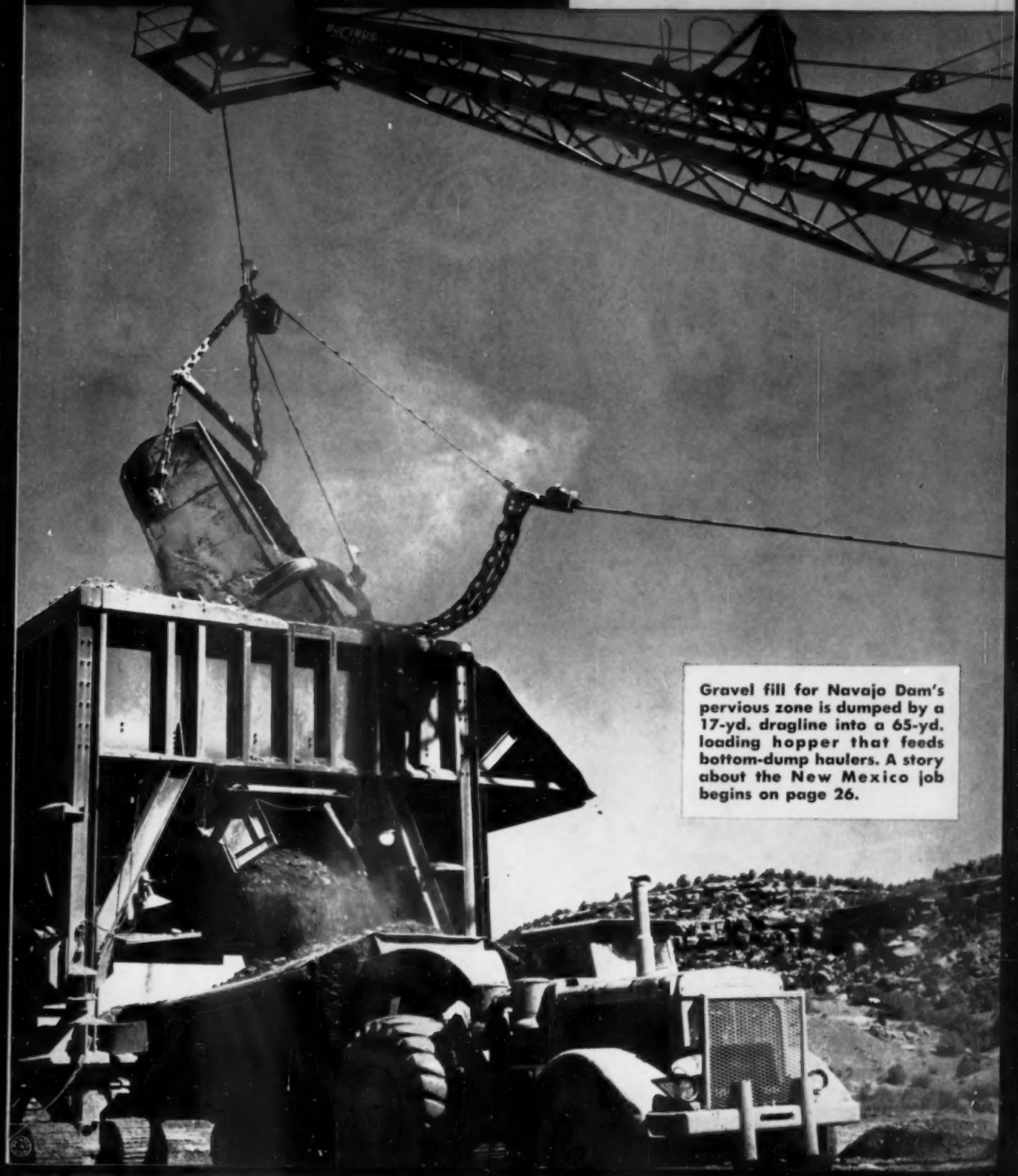
Excavating Engineer

founded 1905

JUNE 1960



Gravel fill for Navajo Dam's pervious zone is dumped by a 17-yd. dragline into a 65-yd. loading hopper that feeds bottom-dump haulers. A story about the New Mexico job begins on page 26.

3½

4

5 YARD?

If you're ready to move up for bigger profits, check the new 71-B Series Two. Based on your application, this machine makes these capacities available as a shovel-dragline-hoe. The 71-B dragline shown is equipped with 70′ boom and 5-yard Bucyrus-Erie BM bucket. Get the facts: Bucyrus-Erie Co., South Milwaukee, Wisconsin.

36E60

BUCYRUS-ERIE

Excavating Engineer

South Milwaukee, Wisconsin

founded 1905

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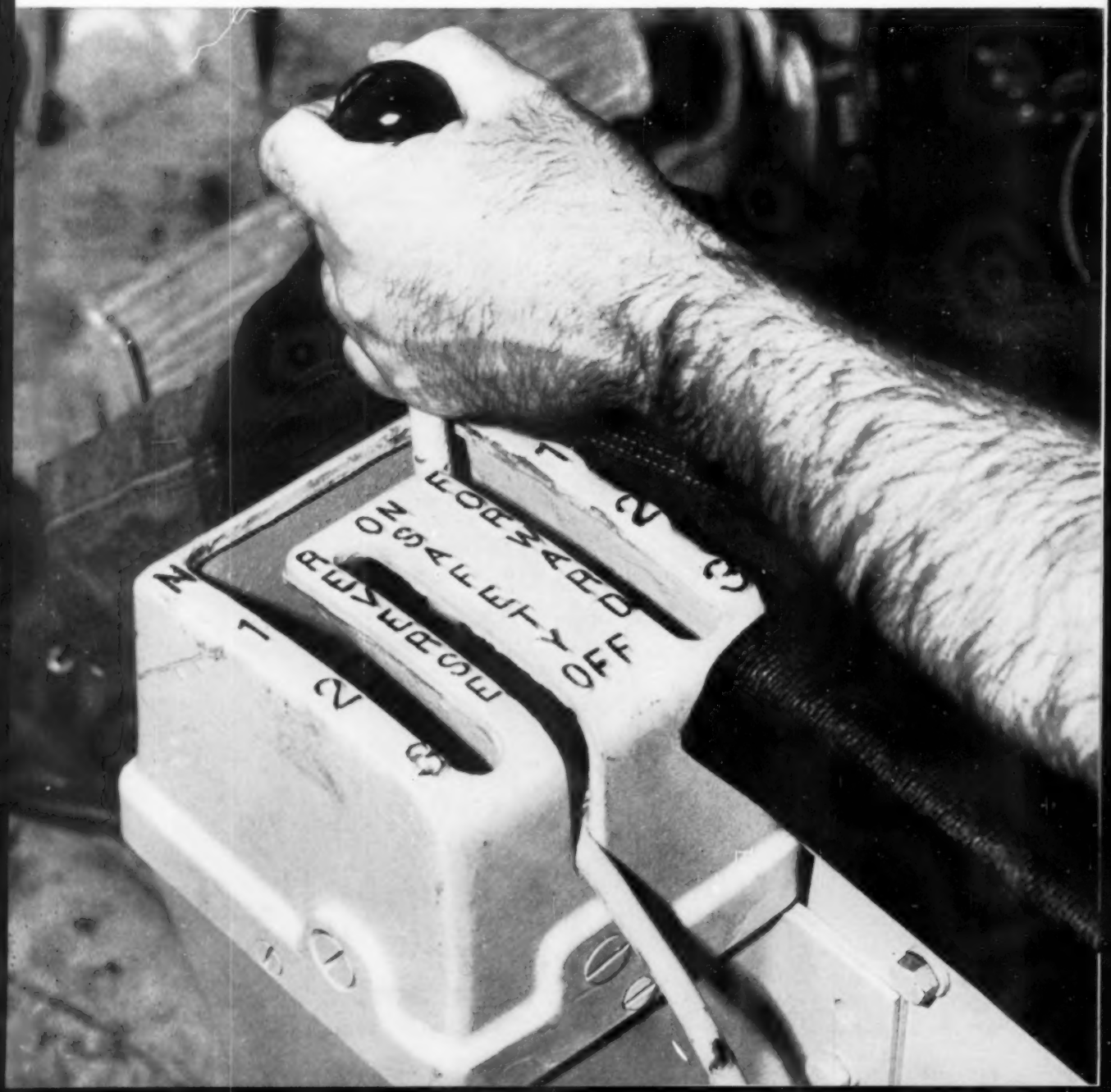
33-50% MORE

New Cat D9E Tractors with pay their own way with

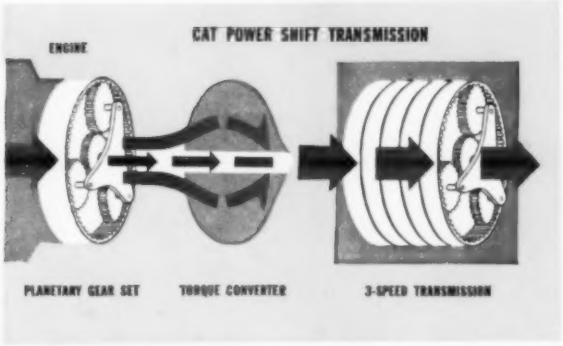
ONE LEVER DOES IT ALL!



PRODUCTION!

full power shift transmissions outstanding performance

- **Shifts on-the-go under full load in a split second!**
- **Changes to all speed ranges, reverses direction!**
- **One control lever—and no braking or clutching!**



Basic design: Total power is transmitted from the engine to a planetary gear arrangement mounted on the engine flywheel. A torque divider directs the total power—part through a direct drive shaft straight to the transmission and the remainder through a torque converter to the transmission. This enables the Cat power shift transmission to combine the economy and quick response of direct drive with the anti-stall and acceleration against load of torque converter drive. Unit construction makes it easy to service, if required. It's tough—one rugged ton built with the precision of a fine watch.

50% more production! D9E, owned by Carmichael Coal Co. near Calumet, Alabama, removes overburden of shale, sandstone and clay to uncover 30" coal seam. Coal production is 9000 tons a month.

33% more production! Overburden, running to 60', is blasted and then cleared by a D9E. Owner: McCoy Coal Company, Gorgas, Alabama. 1,800,000 yards is moved to mine 150,000 tons of coal per year.

Trading in another large track-type machine for a Caterpillar D9E Tractor has brought *big* production increases to two strip mine operators—increases that prove these power shift machines are quickly paying for themselves on the very tough jobs found in overburden removal.

"We're getting half again as much production with no additional cost," says F. M. Carmichael, part owner of Carmichael Coal Co. near Calumet, Ala. "Power shift cuts operator fatigue and increases the maneuverability of the tractor." That's exactly the reason for designing a Caterpillar transmission with a one-hand control which shifts into all speed ranges, forward or reverse and on-the-go, without braking, and without a master clutch.

Earl McCoy, owner of the McCoy Coal Company, Gorgas, Alabama, has had nearly as good results. "We're getting 33⅓% more production with the D9E over the machine we traded in . . . it's more economical to operate."

The D9E, like all Caterpillar track-type Tractors, has lifetime lubricated track rollers (with the exclusive patented floating ring seals) that never need servicing. Also a dollar-saving dry-type air cleaner that can be serviced in just five minutes, yet filters the air 99.8% clean *even in the worst dust conditions.* And shifting is so easy the operator just naturally gets more work out of the tractor. What's more, he gets it on the toughest, most demanding jobs.

Besides power shift transmission, you have your choice of direct drive or torque converter in both the 335 HP D9E and the 235 HP D8H Tractors. For complete details on the new power shift transmission, see your Caterpillar Dealer. He's ready to show how it works . . . demonstrate ruggedness under complete, easy one-hand control!

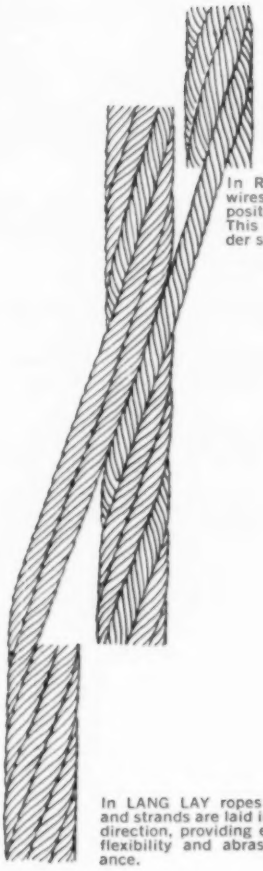
Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

STEP UP PRODUCTION AND PROFITS WITH POWER SHIFT TRANSMISSION

HEAVIER OUTSIDE WIRES mean great resistance to abrasion. FINER INSIDE WIRES mean excellent drum winding characteristics.



In REGULAR LAY ropes the wires are laid in a direction opposite to the lay of the strands. This provides stability even under severe operating conditions.

In LANG LAY ropes the wires and strands are laid in the same direction, providing exceptional flexibility and abrasion resistance.

Two ropes in one! Roebling Herringbone® Wire Rope is designed and made to wear better, work better, last longer than you can possibly imagine . . . unless you've tried it yourself!

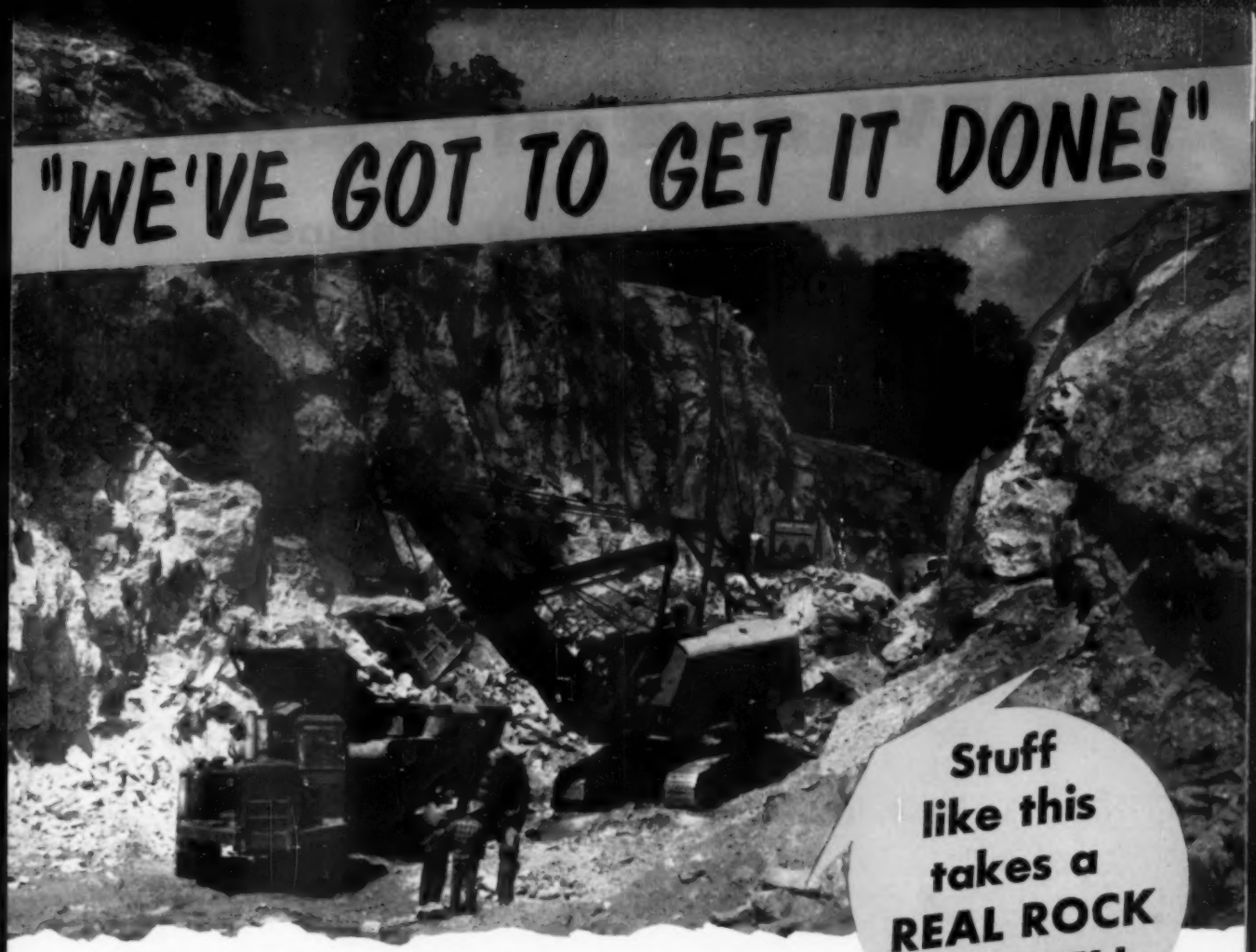
Herringbone combines two pairs of Lang Lay strands with one pair of regular lay strands to give you maximum flexibility, good stability, mighty strength. Call your Roebling Distributor — or write for details to Roebling's Wire Rope Division, Trenton 2, N. J.

HERRINGBONE WIRE ROPE

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

"WE'VE GOT TO GET IT DONE!"



Stuff like this takes a REAL ROCK SHOVEL!

On visits to jobs to get the real story of Northwests at work we often find many machines. It is no accident that almost invariably a Northwest is pioneering in the heaviest digging—the rock digging! "Why", we ask, "do you choose the Northwest for the rock work?" Always, the answer is the same, "We've got to get it done!"

Watch a Northwest Shovel at work in rock! The Northwest Dual Independent Crowd utilizes force most other independent crowd shovels waste. The swing is smooth. The load is spotted in one clean move. It's in the truck and the dipper is back in the bank.

Hour after hour—day after day—yard after yard, that's what makes production. Your Northwest is always ready to go. *We hear it everywhere and Northwest users will tell you so.* The "Feather-Touch" Clutch Control makes operation easy without resorting to pumps, compressors and other delicate mechanisms. The Cushion Clutch eliminates the detrimental effects of shock loads and makes ample power safe. It brings you a combination of advantages that has proved its ability to get high output in rock and make easy digging easier. It gets things done!

NORTHWEST ENGINEERING COMPANY
1506 Field Building, 135 South LaSalle Street
Chicago 3, Illinois

NORTHWEST *Always Ready to* **GO**

S-80-59-L

NORTHWEST EQUIPMENT IS BUILT IN THE FOLLOWING SIZES

SHOVELS	CRANES	DRAGLINES	PULLSHOVELS	TRUCK CRANES
¾ Yd. to 2½ Yd. Capacity	13-Ton to 60-Ton Capacity	¾ Yd. to 3 Yd. Capacity	¾ Yd. to 3½ Yd. Capacity	25-Ton and 35-Ton Capacity

A NEW and DIFFERENT

The first machine ever designed for YOUR hauling problems

You can tell just by *looking* at an LW Haulpak® that it's quite unlike any other off-road hauler. Its bowl, for instance, has a distinctive "V" shape; its wheelbase is obviously shorter; it has clean lines, with none of the "hung on" tanks and cleaners so common to other haulers. Yet, these *noticeable* characteristics only *begin* to tell the story. The *fact* is that Haulpak is *completely* different from other off-road haulers!

Behind these differences are two facts: (1) Haulpak is built by a pioneer in heavy-duty *earthmoving* equipment; not by an automotive manufacturer . . . and (2) Haulpak is *designed*, from the ground up, *as an off-road hauler;* it is *not* just a beefed-up highway truck!

Haulpak differences are not "gimmicks", added on for the sake of being different. Everything you see in Haulpak has been carefully engineered with one objective in mind: to give you lower ton-mile costs on your off-road hauling.

Check the exclusive Haulpak advantages described in these pages. Then arrange with your LeTourneau-Westinghouse Distributor to personally inspect and test one of these high-production, low-cost machines. You'll see first-hand how LW Haulpak design can pay off for you.

How LW Haulpak pays off for **Utah Construction & Mining Co.**

Accurate records have been kept on an LW 32 Haulpak working for Utah Construction & Mining Co., Cedar City, Utah. When these records were last tabulated, the unit had been in use 10½ months. These are the performance figures:

JOB REPORT

Scheduled hours of operation		2,681
Hours Haulpak worked		2,211
Hours lost due to Haulpak downtime		250
Hours lost for other reasons than Haulpak being down		220
Operating efficiency $\frac{2,211 + 220}{2,681}$		90.7%
Best month's operating efficiency (except Aug. '58 which was 100%) was in November, 1958		98.0%
Hours of overburden haul	approx.	1,665
Total bank cubic yards overburden hauled		206,164
Total loads hauled		13,744
Bank yards overburden hauled per load	average	15
Average loads per hour (conditions: 2,000 ft. one way, grades from + 8% to − 8%)		8.25
Hours of iron ore haul	approx.	546
Total tons, ore hauled		80,266
Total loads of ore hauled		2,112
Tons of ore hauled per load	average	38.0
Average loads hauled per hour (conditions: 10,000 ft. one way, grades from + 5% to − 5%)	average	3.87

How does <u>your</u> availability and production compare?

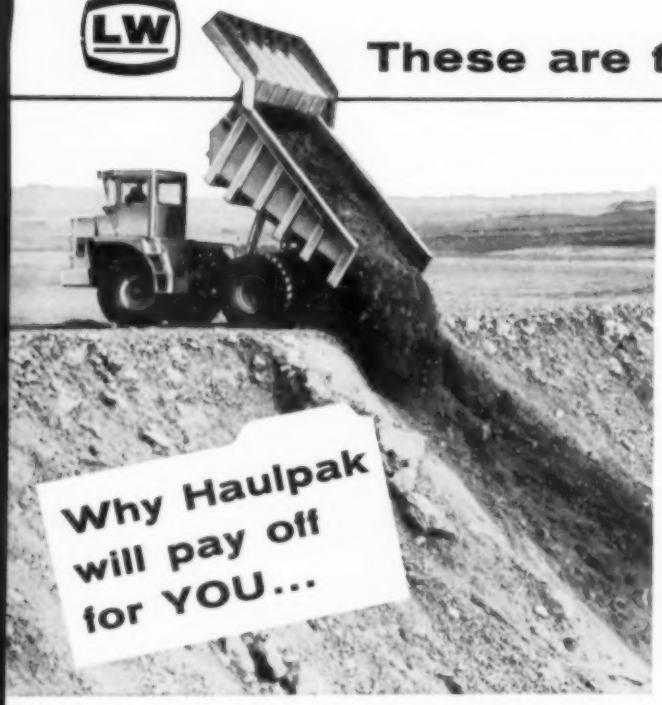
Hauler...built for YOU!

HAULPAK

LW 27.....27 tons

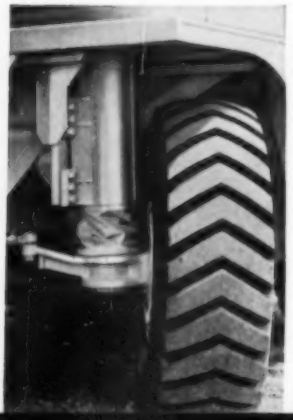
LW 32.....32 tons

These are the HAULPAK advantages



A highway truck cannot become an off-road hauler just by increasing its "iron", horsepower, or capacity. That's why LW engineers "threw out the book" when designing Haulpak. They started from the ground up to design a *new* concept in off-road haulers. The result is a bigger, tougher, faster, safer machine... with bigger returns on your hauler investment.

1. Biggest radiator in the business. Ample cooling even in 120° operation. (2,000 sq in. of frontal fin cooling, plus oil cooler for torque converter fluid.)
2. "Power-Miser" radiator fan, needs less than 10 hp to move 24,000 CFM of air. (Conventional fans need up to 35 hp!) Automatically disengages when not needed.
3. Cab, and engine hood, are fully mounted on rubber to isolate engine vibrations.
4. 15° windshield tilt reduces glare, keeps dirt and moisture from accumulating.
5. Automobile-sized steering wheel turns Haulpak full left to full right in only 4⅛ revolutions. In either direction, inside wheel can be cut full 45°, for non-stop turning circle only 45' in diameter!
6. 52"-wide cab for greater operator comfort and efficiency. Offset to left for full visibility. Five adjustable ventilators. "Buddy" seat for trainee or time-keeper.
7. Double-reduction rear-end of drive train, proved on LW earthmovers around the world. Only 6 big gears, not 12 little gears as in conventional drives. And over 50% stronger than conventional drive trains!
8. 15% less hp is needed to turn gear train than on conventional trucks. Double-reduction axle also permits bolt-circle wheel mounting, for far less trouble.
9. Final drive sections are interchangeable, right and left. All tires are same size and interchangeable.
10. Differential is famed LW power-transfer unit, unequalled for simplicity, trouble-free operation, and effectiveness.
11. Frame fabricated of special alloy, high-tensile-strength steel. Modified box section construction, continuous welded with integral front bumper, center members, and rear cross section ... for maximum strength.
12. Exhaust-heated body is standard. Keeps body dry for easy discharge of wet, sticky materials. Eliminates exhaust stack, and muffles operation of truck, for greater operator efficiency, safety.
13. Separate emergency power-steering system.
14. Power-assist steering is standard equipment. All steering components are at least 30" above ground.
15. 25" front ground clearance ... 6 to 10 inches more than other haulers.
16. 9'8" width between front wheels, compared to 7' on other trucks.
17. Aircraft-type multiple-disc brakes ... four times bigger than most haulers offer. *Three other brake systems*, including hydraulic retarder.
18. Body is completely rubber-mounted. No wear bars or end plates needed.
19. 4,750 cu in. of high-pressure air storage *in frame*, eliminates need for externally-mounted air storage tank.
20. Twin rams raise body 70° in 16 seconds! Inverted ram mounting avoids dirt falling into ram seals, permits shorter, simpler circuit.
21. Deep-well "V"-shape body carries about 6 tons of material below floor line of conventional vehicles. Gives Haulpak lowest center of gravity, solid stability on turns and side-slope operations.
22. Fuel (105 gallons) is stored in rear frame structure, with convenient center-fill. No need for big, clumsy tank, and not exposed to damage.
23. Straight, smooth body floor speeds ejection. No "kick up" at back, means unit stays steady, and on ground, when dumping.
24. Floor made of super-strength 100,000 PSI yield steel, as is *every* Haulpak surface in contact with the load!

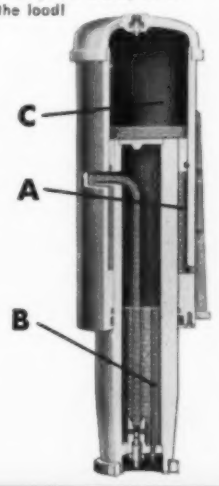


Perhaps the BIGGEST "difference": Revolutionary Hydrair* Suspension

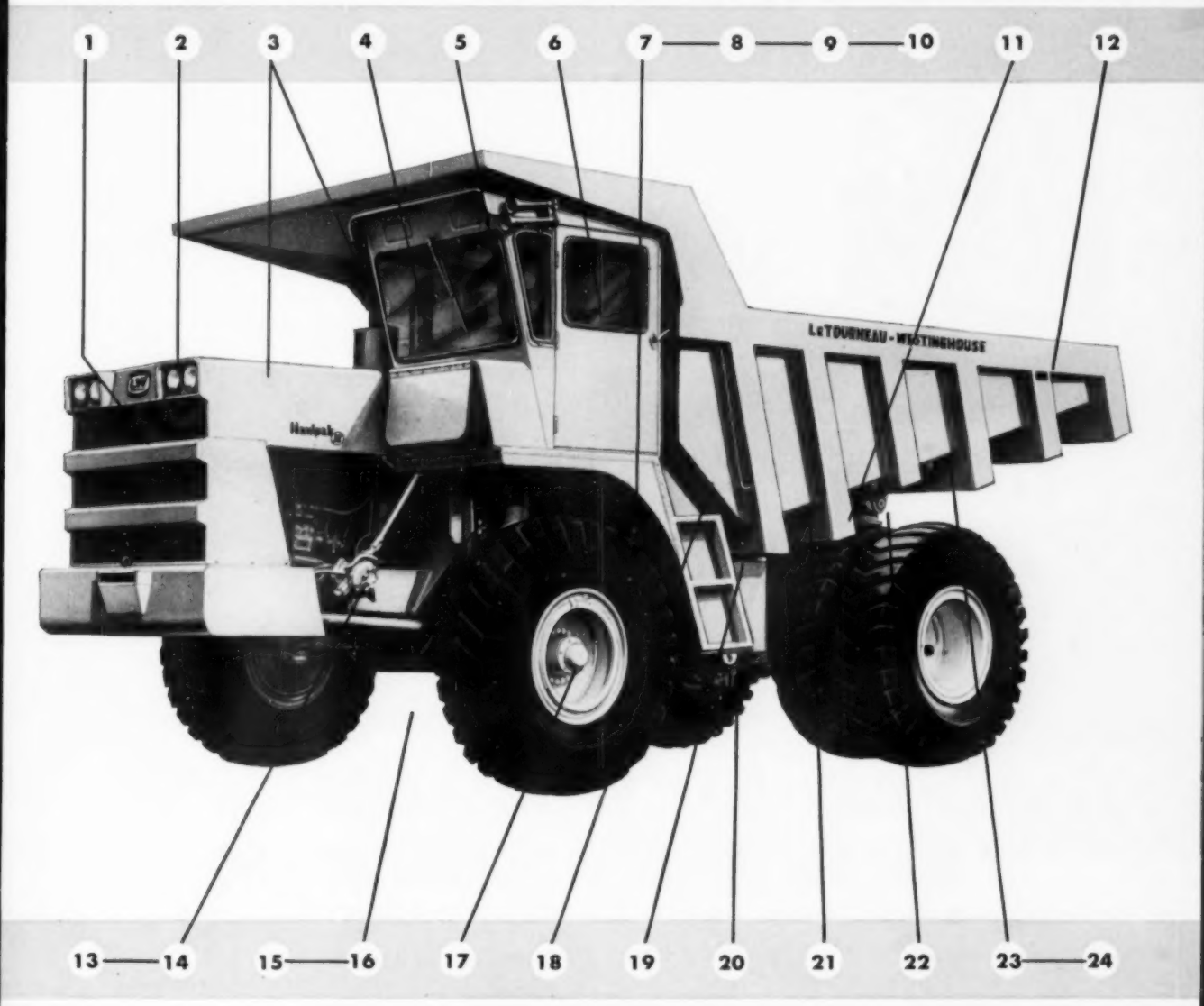
Most *unusual* feature of Haulpak is Hydrair suspension. Each front wheel is mounted to a piston, which operates inside a frame-mounted cylinder. Surrounding the piston is a circular chamber of oil, (A) connected by tube to an oil reservoir (B) inside the piston. As the wheel rolls along surface irregularities, the up and down motion of the piston forces oil in and out of the piston reservoir. This, in turn, compresses and decompresses nitrogen gas contained in the space (C) above the oil reservoir, snubbing the overall movement of the piston and wheel, thus absorbing shocks and leveling the ride.

In addition to these "spring action" benefits, Hydrair eliminates the need for a front axle and related mountings... providing substantially higher ground clearance ... and permitting an exceptionally short turn-radius.

*Trademark



that lower your costs . . . boost your output



See "Revolution on Wheels"...new color film on Haulpak...Ask your LW Distributor

As a specialist in earthmoving and off-road hauling, your LW Distributor can help solve your equipment problems. You'll find him and his staff interested in helping you in all phases of your business . . . from production problems, to machine selection, to financing. Put his experience and know-how to work for *you*. Ask for full details on LW Haulpak trucks. See his color film, "Revolution on Wheels".

HP-2255-G-4

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

HERCULES® ELECTRIC BLASTING CAPS HELP SET WORLD'S RECORD IN TUNNEL DRIVING

"Setting a world's record," says Clancy O'Dell, project manager of the recently holed-through New York City's West Delaware Tunnel, "is largely a combination of loyal skilled tunnel workers and the best and most dependable equipment and supplies." And he should know, for the boring of this 43.64-mile-long water tunnel was finished in the record time of 841,000 man-days, or ten months ahead of schedule.

On this project, the West Delaware Tunnel Constructors also drove a record 2,177 linear feet in a single 31-day period and established a shaft-sinking record of 243 linear feet for a like period.

Hercules® Short-Period Delay Electric Blasting Caps, used almost exclusively in all phases of blasting activity on the West Delaware Tunnel, proved their dependability and efficiency in helping to establish these records.

For complete information on how No Vent® Short-Period Delay Electric Blasting Caps can be applied to your job, call your Hercules representative or write direct to the office nearest you.

Explosives Department

HERCULES POWDER COMPANY

INCORPORATED

900 Market Street, Wilmington 99, Delaware

XHSD-4

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NEW YORK, NEW YORK · PITTSBURGH, PENNSYLVANIA · SALT LAKE CITY, UTAH · SAN FRANCISCO, CALIFORNIA

Pre-stressed concrete or steel . . . . You can't find a better BRIDGE BUILDER

27-ton crane muscles, supplemented by dragline and clamshell help as needed, made this Marion 43-M a triple-threat machine on Oklahoma's largest bridge using prestressed concrete beams.

This Marion wears 36-inch shoes on 15-foot crawler belts that shrug at soft footing, even when handling heavy loads. Its torque converter and foot accelerator let the operator inch big loads into place with ease, confidence and accuracy.

The availability of power load lowering, third drum and independent propel permits owners to custom-select outstanding performance features suited to their job needs.

Get the rest of the story about the 43-M's bridge-building exploits from your nearest Marion Distributor.

You get **MORE** WITH **MARION**

MARION POWER SHOVEL CO. — MARION, OHIO

A Division of Universal Marion Corporation

A welder caused us to caucus

The note from an employee suggestion box read "How come a company like this hasn't got the U. S. Savings Bond Payroll Savings Plan". It was signed by a welder in the fabricating department.

Since we actually *do* have Payroll Savings this told us two things: (1) Probably more employees than we imagined wanted the advantage of buying U. S. Bonds automatically through Payroll Savings. (2) We had grown lax in bringing our Plan to their attention.

But what to do? The solution was simplicity itself.

We called in our State Savings Bonds Director. He provided all the promotional materials needed to arouse interest in U. S. Savings Bonds. Then he helped to conduct a personal canvass and place an application blank in everyone's hands.

The results were amazing. Employee participation shot up to a percentage that we could take pride in. There was no "hard selling", nor was work interrupted. Our people wanted the security U. S. Savings Bonds offer them.

Today there are more Payroll savers than ever before in peacetime. Your State Director will be happy to help you install a Payroll Savings Plan or build enrollment in one already existing. Look him up in the phone book or write: Savings Bonds Division, U. S. Treasury Dept., Washington, D. C.

EXCAVATING ENGINEER

THE U. S. GOVERNMENT DOES NOT PAY FOR THIS ADVERTISEMENT. THE TREASURY DEPARTMENT THANKS, FOR THEIR PATRIOTIC DONATION, THE ADVERTISING COUNCIL AND THE DONOR ABOVE.

HOW Rock-Ribbed Payhauler® GIVES YOU new load-speeding capacity!

Of all rear-dumps in their size classes, only the International 65 and 95 Payhauler models give you the weight-shedding, strength-multiplying, rock-ribbed corrugated bodies! You trade 2½ tons of power-wasting dead weight for 3 bonus tons of capacity in the new 95 Payhauler!

Only the 65 and 95 Payhauler models have the power "plus" of the direct-start, high-torque, 4-cycle 6-cylinder International "817" Diesel engine! The "95" is powered by the 375-hp DT-817 turbocharged Diesel; the "65" has the same basic, high-output power plant: the naturally-aspirated 250-hp D-817!

Choose the "95" with power-shift torque-converter, or 9-speed air-shift transmission. The "65" comes with 10-speed constant-mesh transmission. Both models have the load-speeding safety of reserve-area braking and "one-hand," road-holding power steering! Above, it's the "65" shown storming up a 16% grade with 19-ton payload. Compare how Payhauler grade-ability speeds the cycle over other haulers!

In minimum shovel time you heap-load the big-target Payhauler body. Rugged corrugations absorb rock-shock—give high resistance to wear and distortion from abrasion and impact! Torque - cushioning planetary-type axles let you apply full power to start and haul full loads!

Add up the capacity-boosting advantages of Payhauler power-to-payload *punch*—super-speedy Payhauler loading, hauling and dumping. See how either the 19-ton "65" or 27-ton "95" can give you gear-faster climb-outs—and haul up to 14% faster than other rear-dumps! See your International Construction Equipment Distributor for a demonstration!

Here's your 76-page cost and production estimating book—*newest, most authentic and complete guide for estimating material-moving costs—and for selecting equipment combinations for top profits, anywhere! Yours for the asking from your International Construction Equipment Distributor!*

Get 11-second Payhauler dumping with exclusive, action-speeding inverted hoist design! Simple, easy-to-operate up-and-down snubbing control prevents machine-punishing impact! Fast reverse, up to 7.1 mph., speeds spotting to dump or load!

International® Construction Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE

Even moving a blade-full of shot-rock around the curve, there's no hesitation, no sluing to spill the load. The TD-25's operator has separate speed control of each track to get full-capacity performance, full time. And only the new TD-25 has the power plus of the direct-start, turbocharged DT-817 International engine—that delivers 230 high-torque hp!

HOW POWER-STEERED, POWER-SHIFTED . . . TD-25 takes

—on California mining operation

Even before all the blast dust has settled, this International TD-25 is slamming tons of shot-rock from the benches, so trucks can resume hauling to the processing plant. Then, at this gypsum mine in California, the "25" takes over the "shovel-feeding" chore—dozing full blades of rock upgrade, downgrade, and 'round the curves, to help keep the big dippers swinging full. And in between times, the "25" takes over its third tough project: benching new haul road around mountain slopes!

Three slam-bang rock operations to handle—it's a made-to-order situation for the Planet Power-steered TD-25!

"Dead-track drag" eliminated! You don't brake a track and "half-kill" your pull-power to turn, as you do with king-sized clutch-steered crawlers. With Planet Power-steering you simply change the speed of one TD-25 track—on-the-go, and with 2-finger ease! Around comes the fully-loaded TD-25—with "live" power on both tracks and both tracks pulling. Load-limiting "dead-track drag" is eliminated!

And combined, on-the-go Hi-Lo power-shifting lets you match power to load, instantly—forward or reverse. Just shift one track to high range—the other to low—to do slope-hugging, full-bite benching, or to operate straight ahead with off-center loads!

The "25" is platformed on new 7-roller tracks with double-box-beam frames. The design provides super undercarriage strength for slam-bang conditions—strength to match the full effort of the direct-start, high-torque DT-817 International Diesel engine.

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Photographs by courtesy of the National Coal Board, Opencast Executive.

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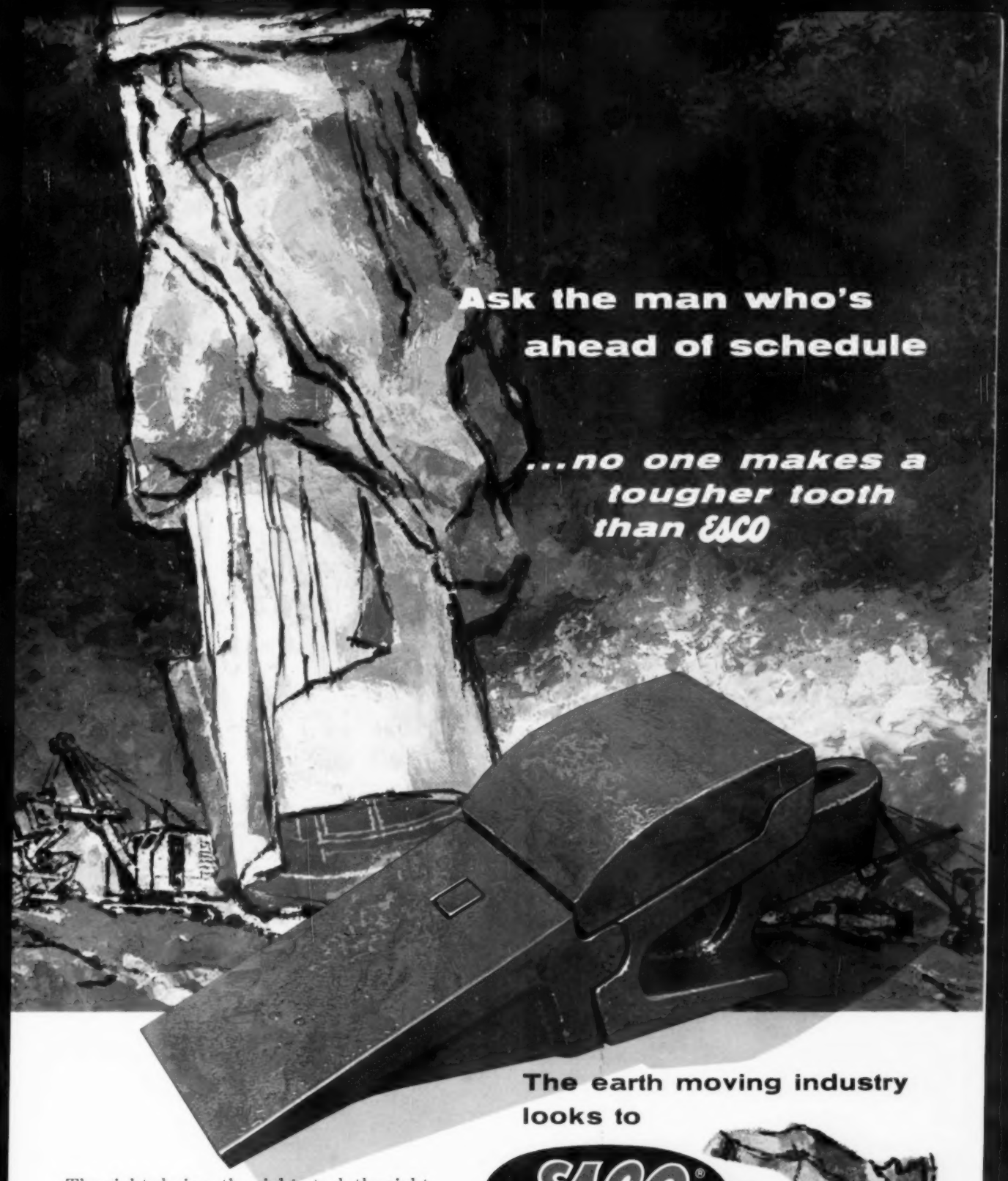

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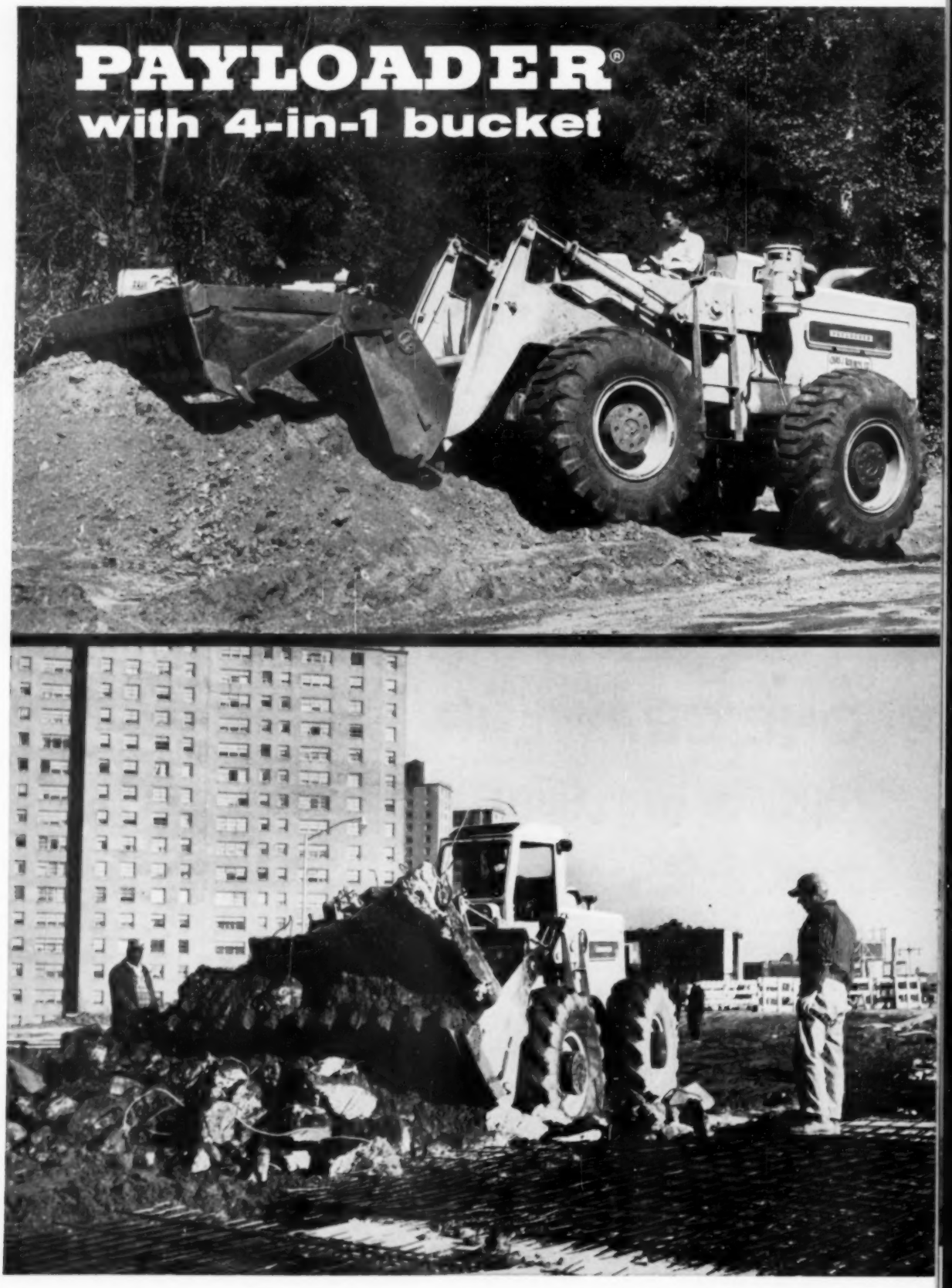
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"We like its durability"

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TYPICAL TRIPS	#1	#2	#3	#1	#2	#3	#1	#2	#3	
15 TON DUMPTOR	:48	:53	:49	:07	:06	:04	:37	:43	:48	1 min. 38 sec.
18 TON REAR DUMP HAULER	1:25	2:00	1:53	:14	:16	:17	1:12	1:09	1:14	3 min. 13 sec.

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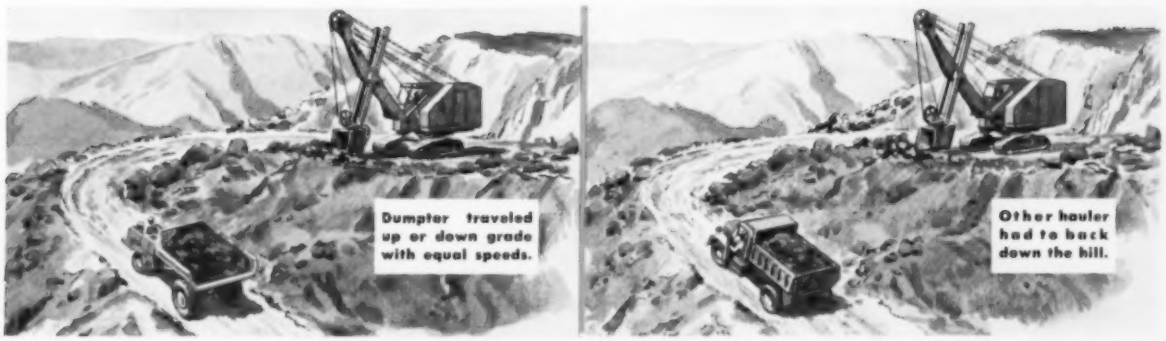

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Rocky Show at Navajo

Contractors on massive 26.3 million-yard barrier in New Mexico contend with heavy, abrasive materials.

by Ray Day

TOUGH . . . brutal . . . disappointing . . . difficult . . . frustrating . . . dangerous.

Each of these adjectives spells Navajo Dam. It's a key structure in the Upper Colorado storage project. Its massive bulk is exceeded, among U. S. Bureau of Reclamation earthfill dams, only by Trinity, in California. When the final chapters are written on western water development, Navajo will rank high on the list of jobs which were tough in every sense.

Some of America's most experienced contractors pooled resources, equipment and personnel know-how to make a successful low bid of $22,822,624 in midsummer of 1958. Morrison-Knudsen Co., the Henry J. Kaiser Co., and F&S Contracting Co., all western firms and all experienced in heavy dam construction, are Navajo's builders. But some of Navajo's peculiar difficulties are new even to them.

Sloughing Rock

The rock is problem-enemy No. 1. In tunnel excavation or vertical face excavation in solid material, it tends to slough badly. High scalers or miners can clean up thoroughly after a blast, but when air and rain contact the clean rock, more chunks break loose. It's made the job dangerous and frustrating.

Or consider rock in the form of cobbles and river gravel. All told, about 15 million cubic yards of rock in this form must be handled. These gravels are so well graded that the fines act as a lubricant. Dig the stuff wet and the only way to move it is with brute force. It won't ridge on a conveyor belt, it clogs mechanical gates, and it's some of the hardest, heaviest material known to construction men.

When a 17-yd. walking-dragline bucket picks up a full load, there's over 70,000 pounds of payload in one bite. If the material has to be hoisted very far, it can downgrade the big machine's production by 200 cubic yards an hour. Another headache—when the material is placed in its designated zone saturated, as specifications require, there are times when even the most powerful earthmoving equipment must be pushed through the fills. That's boosted the number of attendant tractors, on the fill, far higher than was estimated.

If this was just a spot condition or local situation, it wouldn't be so bad. But the fact remains that these are conditions which will affect months and even years of construction work. It will be necessary to meet the rock problem head on until the massive barrier is completed . . . and massive it is.

Rising 405 feet above its Eocene bedrock foundation in a deep, curving canyon on the San Juan River 39 miles east of Farmington, N. M., Navajo Dam will back up a 1,709,000-acre-foot lake 35 miles long, extending into the neighboring state of Colorado. It's a multiple-purpose project. In addition to harnessing the flow of the river, it will impound the necessary storage for the proposed 110,000-acre Navajo Indian irrigation project. It will make possible an

(Left) Electric turbine pump draws river water for irrigation of borrow pits. (Right) Two twin-engine tractors pushload a Euclid TS5-24 twin-engine scraper. This high-production team represents six engines in all, with a total of 1,465 horsepower.

upstream diversion of water for the San Juan-Chama irrigation project.

Present designs do not provide for the generation of hydroelectric power, although the installation of a penstock in the outlet works makes it feasible to add generating facilities later. Some of the planned recreation, wildlife and fishing benefits are being realized already. Every time a borrow-pit pond is unwatered by pumps, several lucky men take home a mess of catfish.

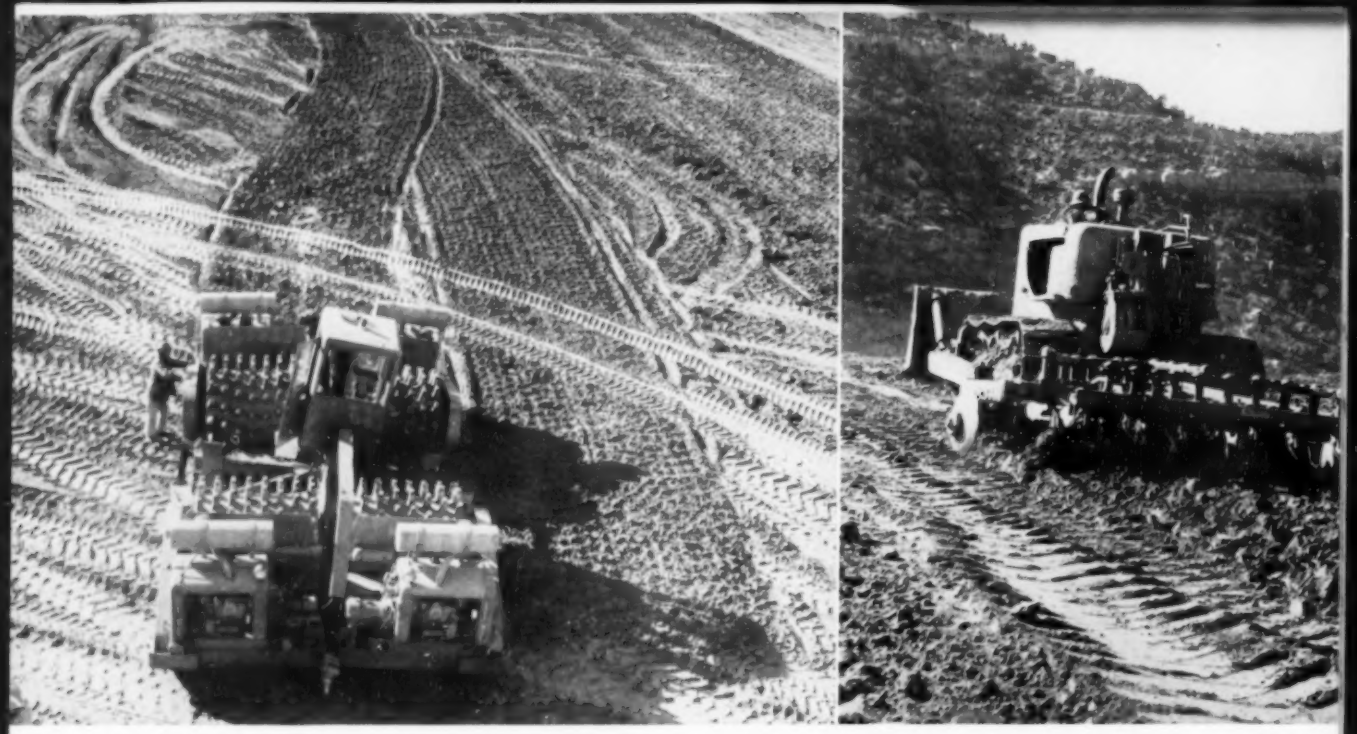
The dam embankment, designed as a triple-zone structure, will have a maximum base width of about one-half mile, and a crest width of 30 feet (6,108 feet above sea level). The Zone 1, or impervious portion of the embankment, will consist of a mixture of selected clay, silt, sand and gravel compacted by tamping rollers in 6-in. layers. Zone 2 consists of selected sand, gravel and cobbles compacted by crawler-type tractors or vibrating rollers, which the Bureau has approved, in 18-in. layers. Zone 3 consists of a mixture of selected clay, silt, sand and gravel compacted by rollers in 12-in. lifts. The upstream slope of the embankment above Elevation 5985 is to be protected from wave action by heavy rock riprap.

To locate over 26 million cubic yards of earthfill materials for the massive embankment, extensive explorations were made of the river bed and valley floor. Enough materials were found, in an area two miles above and two miles below the dam, to do the job. Sixteen borrow areas were designated, grouped into five sections according to their relative elevations and locations.

After stripping, borrow excavation is essentially a two or three-cut oper-

Armco corrugated metal pipe structure is used to carry the low water flow of the San Juan River. Scraper carries a full load as it roars across the structure heading for fill.

(Above) End-dump Euclid discharges a load of material into the random zone of the dam. (Below) Essick vibratory rollers pulled by an Allis-Chalmers HD-21 then compact it.



(Left) Self-propelled 4-unit Ferguson roller is known as "The Blob." (Right) Discs chop up the fill for a better bind with next layer.

ation. The top cut recovers impervious materials for Zone 1 of the embankment. Underlying the impervious soils, the borrow areas give up a well graded alluvium—cobbles, gravel, sand and silt—for use in Zone 2. A mixture of the two materials from the contact line yields Zone 3 materials.

The zoning scheme for the embankment is designed to make maximum use of the borrow areas. Explorations showed the same general soil profiles in all borrow pits, regardless of their elevation from stream bed. Valley floor pits and those several hundred feet higher all have the same characteristics.

Essentially a huge earthmoving job, current operations have been worked out in an interesting manner around a construction sequence which shapes up in stages.

In Stage 1, the contractors are excavating the right abutment, and starting the fill on the right side of the river, bringing it up on a 4 on 1 slope to Elevation 5900, 208 feet below the crest of the dam. Simultaneously, tunnel and spillway work will go on while the San Juan River flows in its normal channel.

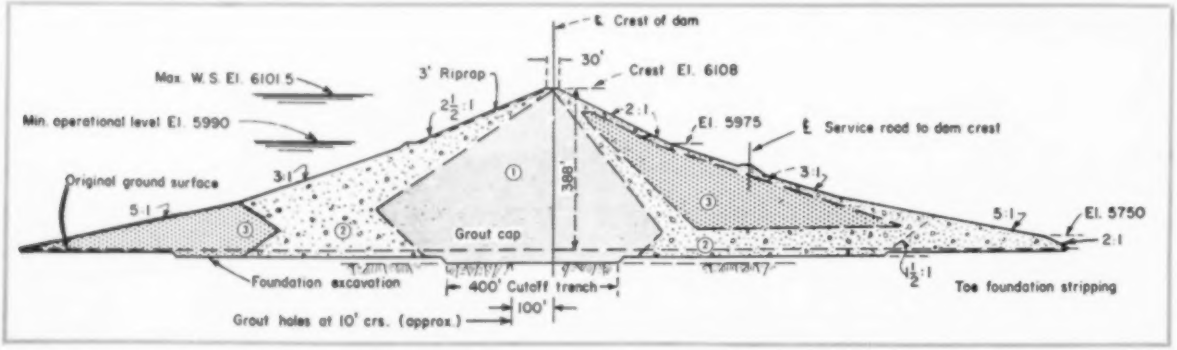
Stage 2 will see the river diverted through the diversion tunnel, by means of a small cofferdam leading from the dam centerline upstream at a 2½ on 1 angle. Specifications permit the contractors to use part of the upstream portion of the earthfill for part of the cofferdam.

Stage 3 will see the remaining abutment and foundation stripping finished, and the earthfill brought up to a safe level where water impoundment can begin. At the same time, the remaining portion of the dam will be finished. The following methods and equipment, used zone by zone, have proved to be most efficient in pushing the earthfill.

Impervious Zone

Zone 1: This zone is the impervious clay barrier, deep in the heart of the dam, which will prevent percolation of reservoir waters beyond a safe point, even when the embankment is saturated for years. It consists of materials scooped off the top of borrow areas above and below the dam, representing one-way equipment hauls up to two miles long.

Realizing the necessity for high



Sectional view of the big fill shows arrangement of its zones. Zone 1 is selected clay, silt, sand and gravel compacted in 6-in. layers. Zone 2 is selected sand, gravel, cobbles and boulders in 18-in. layers. Zone 3 is 12-in. thick layers of miscellaneous.

speed in this operation, the contractors settled on a fleet of 11 Euclid TSS-24 scrapers, normally rated at 24 cubic yards struck capacity. The scrapers were built up with sideboards to 27 yards struck capacity, and engine power was stepped up. Series 110 General Motors diesels were put in, with heavy-duty transmissions strong enough to stand the gaff of loading, dumping and high-speed hauling. Each TSS-24 was equipped with a 365-hp supercharged engine in front, with 220-hp rear pushing unit. This gives each machine 585 horsepower at sea level, or about 525 effective horsepower at Navajo Dam's altitude.

Working with the TSS-24's are four Euclid TC-12's, which give pusher assistance in loading. Most of the hauls are long, and the 50-ft. roads must be kept up perfectly. So, the scrapers are loaded only slightly beyond their struck capacity. That prevents haul-road spillage.

The attention-getting power of these scrapers is apparent through their entire cycle. On valley-floors, where haul roads lead in sweeping gentle curves and straightaways toward the dam, the big units reach speeds of 40 mph. Suddenly, the 27-yd. loads reach a point where ramps lead up to the fill, hundreds of feet above the valley floor. Effortlessly gear changes are made, and while the scrapers slow down, they climb the grades with power to spare. They were topping out on the fill, 270 feet above the valley floor, at speeds of 13 to 15 mph.

Practically all the moisture for this first zone, except the replenishment of moisture lost through evaporation, is being put in ahead of loading. As a matter of fact, specifications require pre-irrigation of the borrow pits 30 days before excavation, as a proper moisture conditioning move. The contractors have extended this to 60 and 90 days ahead, because it gives better results.

Two methods are used. Electric and diesel pumps, working from river sumps, send irrigation water out through aluminum agricultural pipeline systems. There's also been some check-area flooding done, with good results. Introduction of the moisture before excavation has had a good effect on scraper production, too, because the units load easier and faster with moisture at its compaction optimum. There's less dust and dirt to control, and less tendency for material to spill out of the scrapers during the high-speed haul.

Compaction of the impervious material, too, is consequently easier, in relation to compactive effort. Production of the TSS-24 fleet is being handled by one machine—a Ferguson 4-unit self-propelled sheepsfoot roller

This 450-W walking dragline uses a 17-yd. Esco bucket to swing river gravel toward "bang-board" loading station. The walker will handle 12 million cubic yards of gravel.

called "The Blob." This lumbering monster has done such a good job of compaction that USBR engineers have never found a substandard density in their tests of Zone 1. As a standy unit for The Blob, a Peterson double-gang sheepsfoot roller also is used.

For moisture replenishment of surface evaporation on this zone, the contractors have three Euclid-mounted water tank pressure-sprinklers of 3,000, 4,500 and 6,000-gallon capacity. These machines also are used for haul-road sprinkling. Three Allis-Chalmers 45 motor graders handle haul-road maintenance.

Zone 2: In many respects, the work on Zone 2 is one of the most interesting operations on the dam. The material is very abrasive, heavy and hard to handle. To move it uphill is rough, because the material won't cooperate. It must be contained first, then lifted by brute force, and carried to its point of disposal. And even there you have to fight it.

The contractors analyzed Zone 2 carefully, because it represented one of the biggest unknowns of the job. The method chosen was bold, audacious. They'd combine the enormous digging power of a large walking dragline with the equally high hauling ability of a fleet of large bottom-dump wagons.

A Bucyrus-Erie 450-W walking dragline was selected as the loading machine. Purchased originally for coal stripping at Madisonville, Ky., the big walker moved millions of yards there, then saw more coal-stripping service at Kemmerer, Wyo. Later, it was moved to the Saint Lawrence Seaway project for the battle of its life in glacial till, and—still very much in condition—was shipped to New Mexico for the Navajo Dam job.

Originally, the dragline had a 9-yd. rated capacity with a 200-ft. long boom. This boom has been shortened to 125 feet, and the machine now carries an Esco perforated bucket of 17-yd. capacity. A spare Hendrix 15-yd. bucket also is on the job for use in the heaviest materials, and at other times when the larger bucket is being worked on. The big walker gets its power from an 850-hp Cooper-Bessemer JS-8 diesel engine.

Working with the dragline are 12 Euclid 37-LDT's, which have been built up to 30-yd. capacity. Here's where planning ingenuity entered the picture. How could the double bucketloads from the walker best be placed in these hauling units?

Cuts Standby Time

Project officials knew that the digging ability of the dragline was such that 900 cubic yards an hour could be realized, *if* that production could be gotten into the hauling units as fast as the walker would dig it. Obviously it couldn't be dumped in the Eucs direct, for three reasons. First, the shock load would be too great, and there would be too much control-cable damage. Second, production of both the dragline and hauling units would suffer if Eucs were held long enough for direct loading. Actual tests were made using this method, incidentally, and it showed a production dropoff of 200 cubic yards and more per hour. Third, the material would have to be hoisted too far by this method.

Paydirt rolls off the bang-board into the bed of a belly-dump Euc. Two bucket-loads are enough to fill a hauler this size.

The contractors found their answer in the form of a transition hopper, which was built to their own specifications by Conveyor Co., of Los Angeles. Mounted on crawler tracks, the 65-yd. capacity hopper was built sufficiently heavy to stand up under shock-load dumping from the dragline bucket. It was also equipped with gated openings, so that Euclids could take their loads from underneath in a manner which reduced sudden shock strains, but gave the belly-dumps their load in less than 30 seconds.

That of course reduced the standby time of the Eucs, and it made the dragline's work cycle much more efficient by letting it dump rapidly.

Other interesting production aspects entered here, too. By placing the hopper at a practical low elevation in the pit, much hoisting time could be eliminated. In other words, when the bucket reached its full loading point, two-thirds of the necessary hoisting to the top of the hopper already had been done. In the short 90° swing to the top of the hopper, the remaining hoist distance could be

This is how the Bureau of Reclamation's Navajo Dam and its reservoir will look in 1963. The earth and rock-fill structure is 405 feet high and 3,700 feet long at its crest.

covered, so there was little lost motion. On one of the early pit setups where the dragline worked from a high bank, the idea worked perfectly and production peaked at 1,000 cubic yards an hour.

Unfortunately, not all Zone 2 excavation will be that efficient or that easy. When excavation gets down close to the ground water line, and the material is saturated, it becomes tricky indeed. The fines in the gravel tend to lubricate the mass. Banks won't stand up. When some of the pictures for this article were taken, the big walker was digging against a 12-ft. face . . . and there were times when its 17-yd. bucket had worked against even shallower banks. In some materials the gates of the hopper wouldn't work effectively, so that a steel "bang-board" had to be used to take the loading shock off the Eucs. The bang-board also was used where ground water conditions were such that the hopper couldn't be set up.

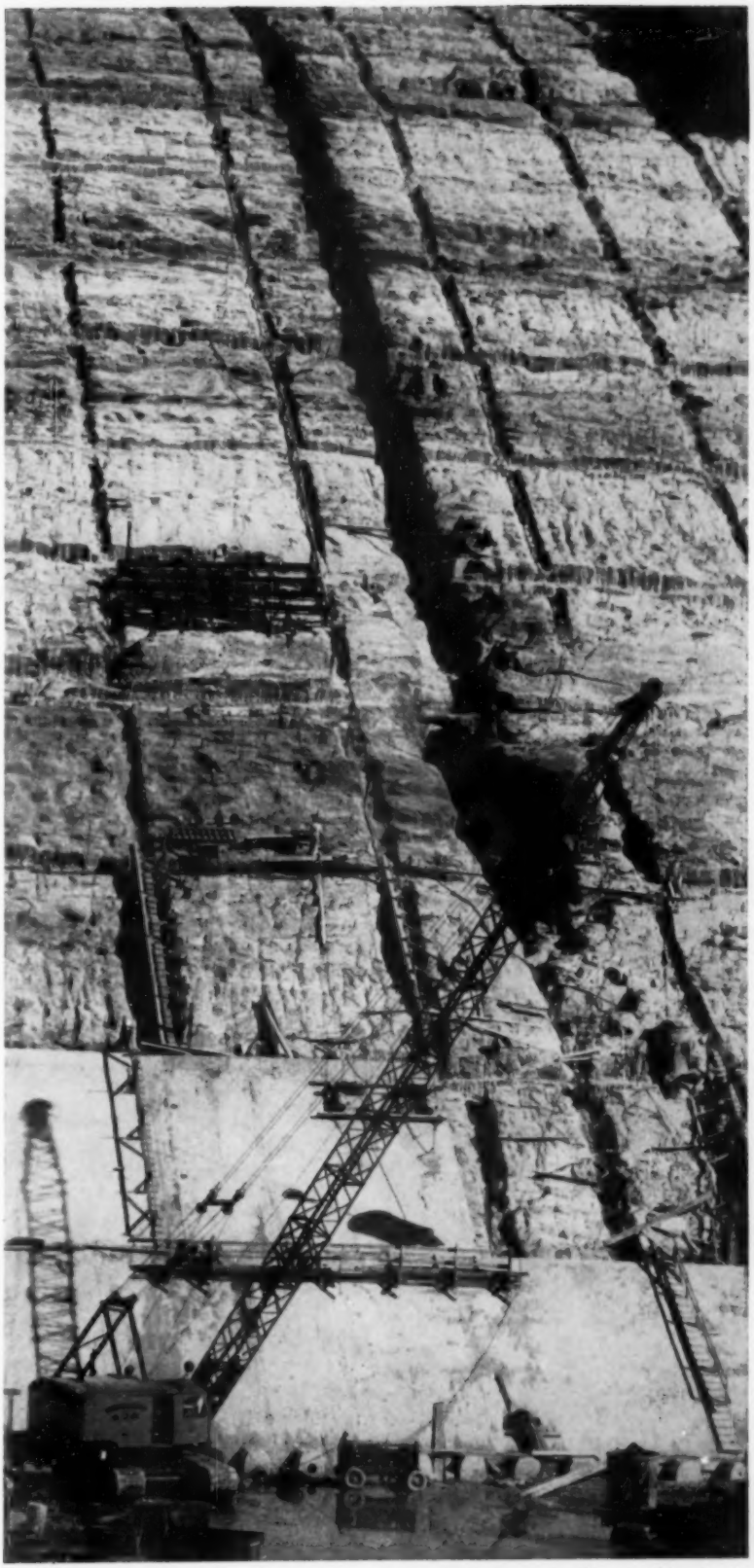
Difficulty with the gravel doesn't end with its loading. When the Eucs get the material to the fill, it's dumped in 18-in. lifts. In its saturated state, the material is heavy, soggy, tough to get through.

Original specifications provided for tractor rolling of Zone 2, but the contractors elected to do a better job at more reasonable cost by using vibratory compaction. Three Essick vibratory rollers were mounted so that full coverage of three drum widths was secured. These units are being towed by one of 14 Allis-Chalmers HD-21 tractors at Navajo. A spare Essick roller is on the job in case one of the other three needs service or repair.

Catchall Zone

Zone 3: This zone is frequently referred to as a "catchall" zone, but it's an important block of the earthfill, nevertheless, because of its buttressing effect. Several materials enter into this zone—silt and sand from the contact portion between Zone 1 and Zone 2 materials, plus whatever gravels are needed to round out this portion. Dragline-excavated gravels are often used here.

Much of the material in this zone is furnished from miscellaneous excavations, such as abutment stripping, foundation cleanup and spillway excavation. Ten Euclid 63-TD end-dump trucks, their beds heaped high with material from a Northwest 80-D 2½-yd. shovel and a 3-yd. 71-B, are



A Northwest 95 crane places concrete with a transfer bucket at spillway stilling basin level. Excavation of under-drain trenches into solid rock was a tough problem.

being used to move muck into Zone 3. This material is being placed in 12-in. lifts, and like the gravels of Zone 2, compacted by the triple-unit Essick vibratory roller.

Abutment stripping and foundation cleanup, which produced many of the materials for this zone, was fairly complicated, even though the geology is definitely favorable so far as engineering is concerned.

River Turns

Just above the dam site, the San Juan flows in a southerly direction. At the upstream toe of the dam, it makes a sharp hairpin turn, and flows nearly north for about a thousand feet before continuing on to the west. This sharp curve leaves a long, narrow sandstone point projecting out from the right side, which serves as the right abutment. The left abutment is a steep slope which continues around a long, sweeping curve.

The rock belongs to the Wasatch formation, and consists principally of standstone with minor beds of shale. The rock is massive, with many beds up to 50 feet thick. It's moderately well-cemented in the more resistant beds, but some layers crush easily. Shaly beds predominate near the river surface, and are usually 2 to 10 feet thick, separated by equally thick beds of sandstone. Strata are not continuous for great lateral distances. Shales grade into sandstone abruptly; sandstones change to shales. This is typical of such continental formations as the Wasatch.

This 65-yd. capacity hopper lets the walking dragline hit a production of 1,000 yards an hour and saves Euclids from loading shocks. Belly-dumps take loads in 30 seconds.

In general, the sandstone is finer grained and more completely cemented in the lower half of the abutments than in the upper half. Some coarse grained sandstone is found near the spillway, which is poorly cemented and porous. It is so friable it can be crushed in the fingers. These beds are localized, and represent a small area near the top of the abutment.

In general, the rock is fairly free from joints, except near the surface on steep slopes. Here the hillside creep, due to softening and settlement in the shale beds, leaves vertical fractures in the sandstone. The left abutment contains more open fractures than the right, because it is steeper and contains more shale. The rock is generally watertight below river level, but it will be made even more so by high pressure grouting 260 feet deep.

Several methods have been used to clean foundations and abutments. One of the best, in softer materials, has been the use of Double J ripper shanks and plates on Caterpillar D9 and Allis-Chalmers HD-21 tractors. The Double J Breaker shank is relatively straight, curving sharply at a heel point where the hinged plate is mounted. This is a triangular, sharpened plate which slices the shale and sandstone with a knife effect. Used behind a tractor as powerful as the D9, two of these shanks break the material both vertically and horizontally in wide, deep waves, so that dozers can shove the material at high speed toward power shovels working below. The ripper points are equipped with quickly detachable H&L teeth, so that when points are worn, they can be replaced.

Another method in harder rock has been drilling and shooting. Four Gardner-Denver DH-93 guns on Air-Trac carriages have been used, powered by three Gardner-Denver 900 mobile compressors. A stationary compressor setup also was made, chiefly for tunnel excavation and permanent air, near the top of the right abutment. It consists of electric-powered Ingersoll-Rand 750-cfm compressors. In the solid rock near foundation lines, a considerable amount of local breaking by jackhammers also was necessary.

A new Bucyrus-Erie 88-B shovel was used to good advantage during the first year the job was worked. Using a 4½-yd. dipper, this machine helped to load Euclid end-dumps,

For after-dark operations, Kohler light plants like this supply the floodlights mounted on towers scattered over job.

and was chiefly responsible in its own right for excavating most of the spillway toe. Two of the worst job problems showed up here. The sandstone rock had a marked tendency to slough loose, after it had once been scaled clean. Also, excavation of trenches down into solid rock, for spillway drains, was a slow laborious job. But it finally was finished, despite tough specifications which prohibited the use of explosives within 3 feet of finished grade lines.

Completion of concrete work to close schedules has been one of the most important parts of an ambitious, closely organized progress target. Diversion of the river hinges entirely on a target point midway between completion of the concrete to Elevation 5800, and the flood season of the river this spring.

Diversion must be made when the river is low, and it's equally important that concrete work must be finished to that elevation by then. This includes the intake structure, all lining of the large outlet tunnel, the outlet works, stilling basin and gate structure. The access tunnel must be completed and plugged. Specs called for the spillway to be completed to that point also, or protected during flood stage by a sizable, costly cofferdam.

The contractors elected to complete the whole works to that elevation before diverting early during the winter of 1959, thus saving the expense of a spillway cofferdam downstream.

Aggregates and sand are being manufactured from Borrow Area 9, just below the spillway. The mixes are weighed out by a Noble automatic batch plant, dumped into a pair of Smith 1-yd. mixers on a lower platform, and then the fresh concrete is sent out to the job in Gar-Bro buckets mounted on flat-bed trucks. A Northwest 95 crane handles these buckets at the spillway; a rented Marion 93-M crane handles them at the intake structure. Two Challenge truck mixers also are used, especially for transporting concrete that's to be placed by Pumpcrete methods.

NAVAJO DAM AND RESERVOIR

DAM:

Type	Earth and rock fill
Height above river bed	388 feet
Height above bedrock foundation	405 feet
Crest length	3,700 feet
Crest width	30 feet
Base width	2,500 feet
Volume	26,300,000 yards
Crest elevation	6108
Maximum spillway discharge	34,000 cfs

RESERVOIR:

Capacity, Elev. 6085	1,709,000 acre-feet
Area, Elev. 6085	15,610 acres
Conservation storage, Elev. 5990-6085	1,036,000 acre-feet
Inactive storage, Elev. 5882-5990	498,000 acre-feet
Dead storage, Elev. 5720-5882	175,000 acre-feet
Surcharge storage, max. flood, El. 6085-6102	276,000 acre-feet

Carpenter Yard

Concrete forms are being manufactured on the job at a central carpenter yard, with important exceptions. Blaw-Knox steel tunnel forms were used for tunnel lining. Dixie Form & Engineering Co., San Antonio, Tex., supplied steel forms for the top section of the intake structure, and the air shaft. These forms were fairly light and were easy to handle and hoist.

Navajo is a good job. It radiates a happy atmosphere in its camp, its safety program and in the relationship between its men. Realizing that housing might be inadequate in the sparsely settled region, the contractors set up a 160-unit trailer court at the job site, in which about 130 families live. There's also a 56-man bachelor barracks and four overflow tents. The mess hall manages to serve Waldorf-style meals to rough, whiskered men with red mud on their boots.

The safety program is administered by a full time safety man and a first-aid man on duty 24 hours a day, seven days a week. The U. S. Bureau of Reclamation also administers its own safety rules. Representatives of Employers Mutuals of Wausau, the insurance company, also visit the job from time to time.

Personnel

The job was designed and is being supervised generally by Grant Bloodgood, assistant commissioner of Reclamation and chief engineer, offices in Denver. W. W. Brenner is project construction engineer at the site.

For the contractors, H. D. Gard is project manager. His principal assistants include Marvin Moore, general superintendent; Joe Phillips, night general superintendent; Glen Van Landingham, dragline superintendent; Max Daley, project engineer; Chet Dapron, equipment superintendent; Jim Duggan, concrete superintendent; and P. A. Campbell, office manager and purchasing agent.

(Left) Dan Greenway, tractor operator, holds a job conference with Project Engineer M. C. Daley and Dragline Supt. Glen Van Landingham on how to unwater a borrow area.

"OUR OUTPUT HAS INCREASED ABOUT 10%"

Mr. D. C. Penoyer, of Penoyer's Contracting Company, Clearfield, Pennsylvania, says of his Bucyrus-Erie dragline bucket, "We're pleased with this bucket. It has good digging characteristics; and we estimate our production has increased about 10%."

This 6-yd., type BEH, extra heavy duty bucket is stripping coal in the hills near Clearfield. It produces more because it was designed for big production. That 10% increase is the result of a high-wide arch, tapered basket, and correctly pitched teeth and lip which insure heaped loads and quick, clean dumps.

Its advanced engineering and Becoloy components enable it to take the day-in, day-out pounding and wear of everyday use. The bucket requires a minimum of maintenance.

This bucket was sold by the Beckwith Machinery Company, Pittsburgh, Clearfield, Erie, and Bradford, Pennsylvania. Your Bucyrus-Erie distributor will be glad to give you all the facts about Bucyrus-Erie dragline buckets.

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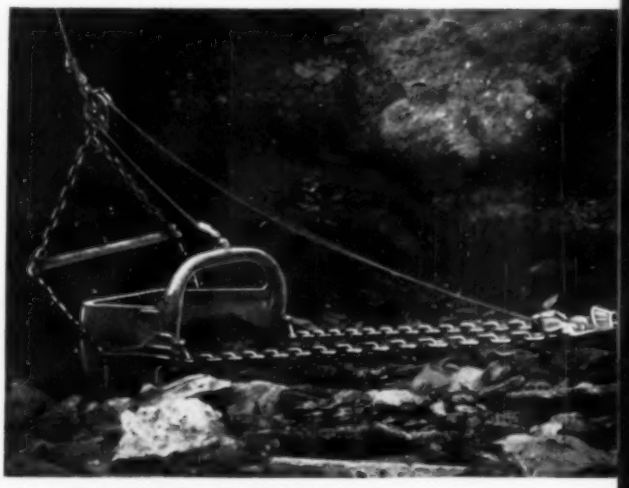
South Milwaukee, Wisconsin

Mr. D. C. Penoyer and son, Bob, pose with their production boosting Bucyrus-Erie bucket.



Penoyer's 6-yd. bucket digs in for load of shale and rock overburden.

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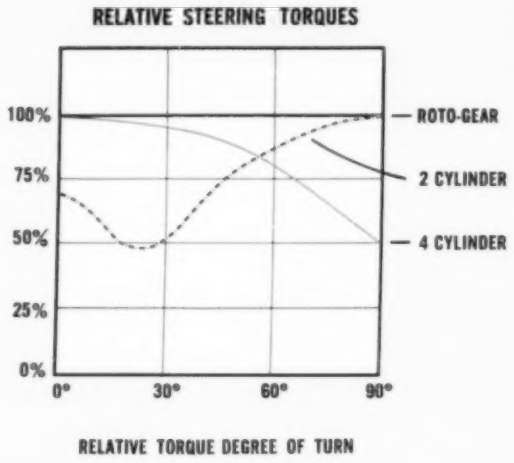
TURN PAGE

SELF-PROPELLED SCRAPER STEERING SYSTEMS

Control is of great importance when handling loaded scrapers with weights in excess of 80 tons. Steering must be smooth and responsive in all stages of operation. Anything short of this sacrifices production, safety and operating ease.

The graph on the right compares typical steering torque curves for the three steering systems now used by major scraper manufacturers. The curves shown are actual torque curves from current models. As you can see, the Roto-Gear torque is consistent throughout the steering arc, while the torque of the 2 cylinder and 4 cylinder ram & lever systems vary considerably at different points in the turn.



TWO CYLINDER STEERING

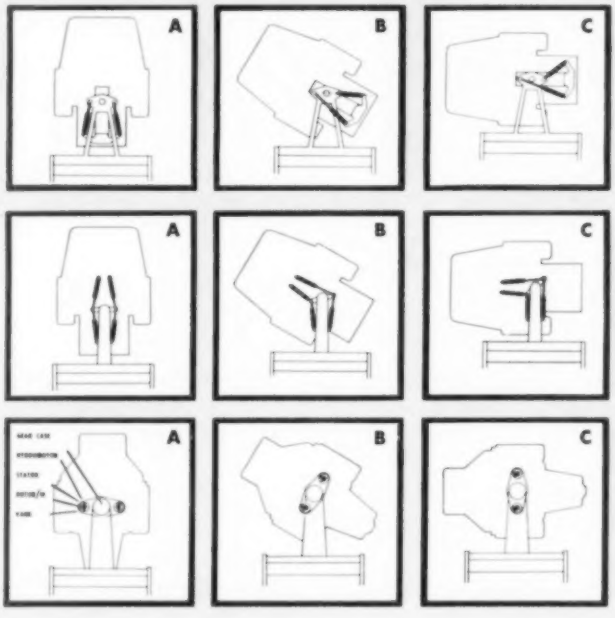
In this system, each of the two double-acting rams works in opposition to the other. Note that in the position indicated in figure 'B', the right arm is in a direct line with the pivot point and can neither push nor pull. Therefore, the right ram must coast through this point leaving the left ram to do the work. This accounts for the loss of torque at this point as shown on the above graph.

FOUR CYLINDER STEERING

In this system the two left rams work together and the two right rams work together. All rams are double acting. With this system, the more nearly the rams are in a straight line, the more effective the steering. As they approach a right angle position, relative to each other, they lose their effectiveness and suffer a loss of steering power. This will be noted on the graph above.

ROTO-GEAR STEERING

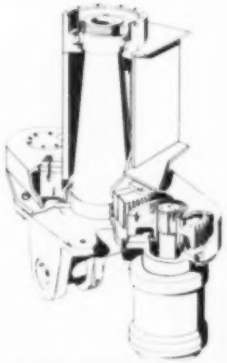
In the Roto-Gear system, there is an even constant pressure against the Hydromotor vanes at every point in the turning arc. Both Hydromotors are in full operation at all times—providing even power throughout the turn.



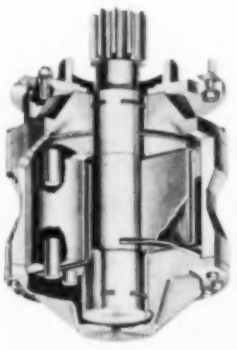
ROTO-GEAR STEERING SYSTEM

With Roto-Gear steer, there are no hydraulic rams. Instead, compact Hydromotors operate the steering gear. As the turn is begun, the hydraulic pump sends fluid into one side of each Hydromotor, causing pressure against the rotor vane. The rotor of each Hydromotor then turns, causing the steering gear to turn in relation to the turn of the steering wheel. The advantages of this system, used ONLY on the Curtiss-Wright scraper line, are (1) Smooth, responsive steering throughout the entire turn, and (2) Elimination of awkward, external steering rams.

For complete details on all the C-W performance features, see your Curtiss-Wright distributor.



DETAIL OF HYDROMOTOR GEAR MECHANISM



CUT-AWAY VIEW OF C-W HYDROMOTOR

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AD NO. 52-83 PRINTED IN U.S.A.

Mechanics Don't Gamble at Navajo

Equipment worth $5 million is maintained by preventing trouble before it happens.

by Ray Day

Preventive maintenance supervisor B. E. Newton (right) points out a tire flaw which needs attention from tire repair man. A close watch is kept on all operating costs.

IN the lonely San Juan River country of northwestern New Mexico, where Navajo Dam is taking shape for the U. S. Bureau of Reclamation, Equipment Superintendent Chet Dapron with a modest force of mechanics and grease monkeys has one of the most important equipment-maintenance jobs that country has seen to date. It's more than usually important because Navajo is primarily an equipment show. Some 130 pieces of mechanical temperament—some more temperamental than others—have to be maintained in working order on the production line.

To the contractors, the assignment is vital. About $5 million has been invested in this equipment, and the only way to justify the expense is to make machines last until Navajo Dam is finished four years from now.

Automatic Procedures

Supt. Dapron's approach to his problem is practical. One of the first questions he asked himself was, "How can I get the most out of my better units unless there's real flexibility in my PM (preventive maintenance) program?" The one at Navajo is geared to that kind of freedom, built around a hard core of routine checking and service which allows little or no latitude.

Example—on the wall of the shop, there's a big board on which equipment numbers are listed. Scheduled service hours are on this board, and equipment is serviced when due, without running into overtime. On a few units which have proved to be unusually better than average, however, there's an allowance made for bypassing things which are causing no trouble.

Evidence of the heads-up program is apparent throughout the busy

This Butler prefab shop is headquarters for all rubber repair and replacement on the job. Service truck has a special hoist.

Navajo Dam scene. Here and there a Cat pulls off and rumbles over to a mobile lube truck for routine service. A big dragline carrying a heavy 17-yd. can, continues swinging hour after hour as it loads gravel into hauling units. These things exemplify the effective results of a well-thought-out maintenance policy.

And it goes much deeper than this, too. An example of the thinking behind this program is a field-service shack idea which Dapron is using. Purpose of the field service shack is to remove much of the lighter work load, congestion and traffic from the headquarters shop. It disperses mechanical manpower, gets it out nearer to the work load in the field. Mounted on skids, the shack can be moved around and kept close to points where a hundred items a day need doing: minor adjustments, cable replacement, bolt and bit replacement, leak stoppages and so on.

Working closely with field fueling trucks, this field facility is ultra-efficient. Twin Euclid TSS-24 scrapers can be fueled, lubricated and minor adjustments made in five minutes, since there are four men at the shack. There's no way to tell how much this idea has added to general safety, because it does away completely with having to move equipment in and out of the area for service.

Painstaking Job

Or consider the logic behind the program's conception. Service and repair is patterned after the preventive maintenance methods on modern aircraft, including jets. These things all indicate how important the subject is to contractor's management officials. Too much money is invested in the equipment on 1960-model jobs to neglect it.

Mobile lubrication rig, loaded with Alemite guns and barrels of D-A lube, catches up to one of the Euclids out on the job.

Busy scene in the field shows Northwest truck crane giving hoist assistance as a maintenance gang works on a roller. Truck with welding equipment stands by.

From a mechanic's standpoint, the Navajo equipment probably isn't the toughest he's ever maintained, but that's chiefly because the contractor's top management has backed up this activity with the finest service money can buy. Actually there are many problems which exert an influence on the program. Three principal ones—logistics, heavier-than-average materials to handle, and a light-density labor-supply area.

The job is about 130 miles north of main U. S. Highway 66, so the dam is somewhat removed from main east-west transcontinental truck lines. Past construction in the Aztec-Farmington region has been mostly uranium development, pipeline construction and gas well drilling, so construction machinery houses as such are chiefly branch stores of parent firms in Albuquerque. The nearest railhead is at Bernalillo, N. M., 135 miles away.

Perhaps in a way, Dapron believes, the manpower situation has worked for the best. The mechanics who hired and stuck are dedicated people, and they will be far better for having had the experience when the dam is finished. Another valuable by-product is a highly competent crew of Euclid TSS-24 operators, all of whom were

mechanic's repair card. Here, repairs and adjustments to equipment are listed as each mechanic summarizes what jobs he's done each day. Here again, the careful conception of the PM program is evident. For only the actual time a mechanic works on a job is charged to each piece of equipment. While waiting time is a necessary cost evil of running a shop, it's not something which should be charged, willy-nilly, to equipment. That tends to unbalance the true picture of what equipment costs to repair. By charging actual time, rather than total time, extremely accurate charges can be established which function as excellent buying and estimating guides, later on.

One of the important forms, too, is a Preventive Maintenance Equipment Summary. Here the ratio of operating hours per repair hour is summarized, along with operating

trained from scratch. This in itself has helped preventive maintenance along, simply by treating the machines right while making them produce.

As to heavier-than-average materials, this happens to be a natural condition of the San Juan alluvium. Some in-place density tests of undisturbed material showed weights up to 4,200 pounds per cubic yard. The alluvium particles are hard, rounded and slickened by silts and clays. Millions of cubic yards of these materials must be handled by equipment, and in the process there are no short cuts to easy maintenance.

Despite the fact that operators aren't mechanics, Dapron has done everything in his power to forge a strong direct link between each equipment operator, and the shop mechanical force. One of the most fundamental parts of the streamlined bookkeeping system consists of a pink operator's daily report, usually referred to as the "bitch sheet."

Turned in daily, and equal in importance to the operator's time card, the bitch sheet is available to the mechanical department for action 15 minutes after any shift closes. If an operator notices any peculiarity, any incipient breakdown, any unusual noise or other departure from normal, it goes promptly on the bitch sheet. Dapron regards this form as one of the most important pieces of paper at the dam.

Rounding out this form is a daily

Everything's huge at Navajo, and Equipment Supt. Chet Dapron shows just how big is a special Cat D9 tool. It's a Double J Breaker plate and ripper shank, with H&L teeth.

hours per man hour of repair time This information is vital to modern contracting. Since the summary sheet lists all pieces of equipment by types, the job's management officials can see at a glance what the comparisons are between types of equipment and makes.

The bookkeeping system doesn't forget the individual machine, either. There's a separate book for each unit. Here, other important things are summarized—the operating efficiency ratio, fuel consumption, a complete history of major repairs, and a transfer history which shows how long a machine worked on a certain job. If a piece of equipment is purchased new, a new book is begun. If a piece of equipment is bought used, a book is started as of that date, carrying an estimate of its current condition.

The mechanical organization is geared for high efficiency; there are not too many men, nor too few. The day shift is the biggest, of course, because more work is done then. On this shift are 19 mechanics, four welders, a cable splicer, a steamcleaner man and two mechanic's helpers.

The swing shift is staffed with 14 mechanics, a steamcleaner man and a mechanic's helper. On graveyard shift, the number of mechanics again is increased to 19, with a steamcleaner man, four welders, and a mechanic's helper. Each of these shifts has a mechanical foreman, too.

An integral part of the organization is the lubrication setup. There are two complete service trucks which carry water, anti-freeze, all lubrication facilities, oil and grease. There are three fuel trucks, too, and two of these operate all the time with the third available on a standby or overflow basis. Two men are assigned to each service truck each shift. Two men also are used on the fuel truck which services the Twin Euclids.

Bulletin board in headquarters shop is kept up to date with postings of operator daily report cards which maintenance supervisor B. E. Newton is holding. Summarized here, they show exactly when a piece of equipment is due for routine service and repair.

Control of issuing of materials is job of the parts man who does an orderly over-the-counter business with shop mechanics.

Special care was desirable for the big walking dragline because the entire job hinges on its performing productively month after month, without down time. For this reason, managers of the job brought in veteran Glen Van Landingham, an old M-K man from away back, who started out with the company many years ago as an operator on these big machines. That was in the era when the first big irrigation canals were being built in the West. Later, Van Landingham was promoted from operator to walking-dragline superintendent. Today he's still a superintendent, but in addition he has his own force of two dragline mechanics. That places full control of the machine in Van Landingham's hands, including both operation and repair, which he can coordinate to best advantage.

In keeping the big machine on the production line, Van Landingham does use certain regular shop facilities, such as welders, special lathe work if necessary, and cable. But his own mechanics service the 850-hp Cooper-Bessemer diesel which powers the 450-W, and they take care of its electrical control system, lubrication and adjustments.

The main repair shop was designed to take care of the heavy, important repair jobs which are necessary on today's heavy equipment working at high capacity. The type of work for which this shop was designed excludes minor adjustment work, spot repairs, and other such jobs the traveling field shack can take care of so admirably.

Large Bays

Three heavy-equipment bays were provided, so that the biggest tractors, the biggest Euclids and other such equipment could enter the shop.

Divisions of the shop include a steam-cleaning room and wash rack, a lathe room, electrical-repair section, a paint shop, tire shop and parts room.

From a standpoint of better equipment in the years ahead, the Navajo Dam job undoubtedly will contribute much that is beneficial. Because this is such a brutal proving ground, manufacturers of all principal lines represented will learn more about their equipment when it comes up against some of the world's worst-handling material.

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Superintendent J. E. Linn, Marriott-Reed Coal Company, Columbia, Missouri, says: "We have been using Westinghouse motors in our mining operation since I began working for A. E. Marriott back in 1926. There is no question but that they are rugged and dependable."

†*Clyde Kennett, St. Louis, Missouri office*

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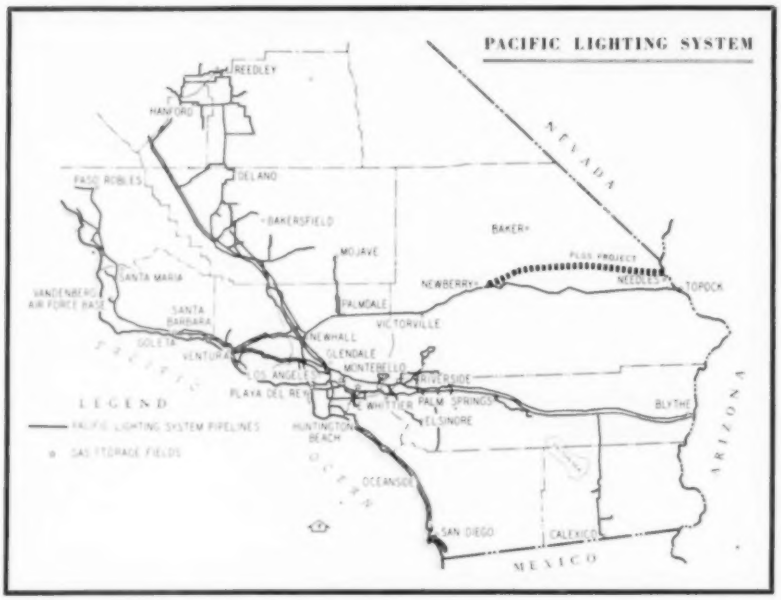
TUNE IN WESTINGHOUSE-CBS TV-RADIO COVERAGE, PRESIDENTIAL CONVENTIONS, JULY 10-29

Desert Pipeline Utilizes Unusual Techniques

Electronic and mechanical devices help contractors speed Mojave desert crossing.



New 34-in., 116-mile pipeline (dotted line) is being installed from Needles to Newberry, Calif. Map also shows Pacific Lighting's integrated pipelines in southern California.

"ALL the gamblers aren't in Las Vegas—some of them are building pipelines," said Spread Superintendent Lee Erlewine, jaw-clenching his pipe and wheeling a new Ford pickup along his 35-mile long right-of-way.

Pipeliners everywhere are at the mercy of the elements, and no more so than on this parched-brown waste of the Mojave desert.

Here they must fight bitter cold and intense heat; needle-sharp blizzards that can shut down the welding crew (or they risk glowing like a neon light); screaming winds that bend the welders' arc, sand-flog the men and whip sand into the open trench. Then there is the land itself, where granite and lava sometimes lie exposed, but as often as not lurk beneath a layer of blow sand.

These are some of the "boxcars" and "snake eyes" which can be thrown, as Erlewine and his crew of 169 men lay a 34-in. 116-mile natural gas transmission line from the California-Arizona state line 7 miles north of Needles to a point near Newberry.

Cleveland 320 ditcher powered by Cat D315 engine gnaws a trench 68 inches deep and 44 inches wide. In rocky stretches of the Mojave desert, the ditch is opened by hoes.

Two Contractors

The job is being joint ventured by Engineers Limited Pipeline Co., of El Cerrito, and Pacific Pipeline Construction Co., of Montebello, Calif.

To lower the odds, the pipeliners are employing several recently developed devices, two of them electronic, one strictly mechanical. The electronic units are a Tellurometer for surveying the line, and a seismic analysis counter for determining the consolidation—hence rippability or nonrippability—of material hidden beneath the surface. The mechanical device, developed on the job, is a shader used to pad the pipe prior to backfilling. These are discussed in detail later.

When completed in July, the $17,300,000 pipeline project will help swell gas supplies for the southern California market by 300 million cubic feet a day, and ultimately by 600 million cfd. It will be owned and operated by Pacific Lighting Gas Sup-

ply Co., the transmission and storage subsidiary of Pacific Lighting Corp., and an affiliate of Southern California and Southern Counties Gas Companies.

Pacific Lighting's integrated system currently serves over 2.3 million meters, more than any other gas distribution system in the nation. In the 12 months ended Sept. 30, 1959, its 24,300 miles of pipeline distributed 484 billion cubic feet of gas in southern California. Speaking before the Los Angeles Society of Security Analysts last November, Robert A. Hornby, president of the corporation, said population estimates show that in 1975 the company must be prepared to serve more than 4.5 million meters.

The current PLGS pipeline project at the eastern end will join the 1,800-mile Transwestern line now under construction. A joint contract by PLGS and Transwestern Pipeline Co., Houston, Tex., was recently let to Missouri Valley Dredging Co., of Omaha, Neb., for twin 24-in. river crossings 14 feet below the bed of the Colorado River. At Newberry, the western point, the line will be tied in with a 36-in. pipeline of Southern California-Southern Counties Gas Companies, which will take the gas to the Los Angeles basin.

Surveyors of PLGS used a new electronic technique in laying out the line. A radar-like device known as a Tellurometer, owned and operated by Aerial Control, Inc. of Los Angeles, measured lines up to 40 miles long in a single setup by means of high-speed microwaves. The survey was not only completed in a fraction of the time required by conventional methods, but provided a high degree of accuracy. Job specifications called for locating each point of the survey within five feet of its true position. The Tellurometer closed with an error of 1 foot in 51,770.

A ¾-yd. hoe digs bell holes at 80-ft. intervals to permit welding the pipe joints within the trench. Holes are cut to a depth of about 86 inches, 18 inches below the trench floor.

Seismic Tests

Another electronic device was used on the project. To find hidden rock and determine its rippability or non-rippability, seismic analysis tests were made along a 40-mile stretch of right-of-way. Seismic analysis is based on the principle of sound or shock waves traveling through varying subsurface materials at different speeds and along separate paths. Information is recorded by an electronic counter. Results of the survey were subsequently borne out in the clearing and grading operation.

Still another unusual piece of equipment is being used on the job. It is

D8 tractor rips and dozes decomposed granite which sometimes lies exposed, but often is found lurking under a layer of sand.

MD7 pipelayer lowers a 10-ft. length of 40-in. diameter casing as crew bores beneath the Santa Fe roadbed. Wall thickness of casings measures 0.688-in. for railroad crossings.

a still-to-be named shading machine put together by Lee Erlewine; Bill Abernathy, owner of Pacific Pipeline; and Wade Bushell, Abernathy's pilot.

Used in backfilling, the shader is a dirt separator which sifts and shoots a stream of fines and 2-in. minus rock over the bedded pipe to a height of about 12 inches. The layer of sifted material shields the wrapping from the rock during the backfilling operation. (A previously-laid 4-in. pad of fines on the floor of the trench protects the bottom of the pipe.)

Necessity gave birth to the unit. PLGS officials felt that the lizard method (a traveling shield above the pipe used to absorb the shock of falling rock) did not completely prevent rocks from scarring or puncturing the wrapping when the shield was removed.

The shader made its initial run in February, four working days after lowering-in began. After a few early stoppages for adjustment, the shader began kicking out fines at the rate of 580 feet per hour. An average of 6,000 to 7,000 feet per day is anticipated.

At first glance the contraption appears to be self-defeating in that it digs a trench to fill another trench. Sort of robbing Peter. But it works.

Gravel Shaker

The shader consists of a combination gravel shaker (obtained at a nearby played-out mine) pulled by a Cat D7 tractor, and a Cleveland 240 ditcher which works adjacent to the shader. The ditcher scoops out a 3-ft. trench and feeds the material to a hopper, where it is picked up by a 60-ft., 36-in. conveyor belt and delivered to the shaker. The latter consists of two sloping 3 x 6-ft. screens. The upper is a 2-in. grid; the lower, a ¾-in. screen. A 12-in. conveyor below the screens carries the sifted material to the trench, while rejected rocks tumble off the back end of the shaker. These are later bladed into the shallow ditch by a No. 12 motor grader. Spoil from the main trench is dozed over the shaded pipe by a Cat D6 tractor with angle blade.

Bill Abernathy readily admitted that the shader would not solve all his problems. There will be stretches where the ditcher will encounter nothing but rock. At such times suitable material will have to be imported. Red Smallwood is in charge of backfill and cleanup phases of the job.

The bell-hole method of pipeline construction is being employed in accordance with PLGS contract specifications. Pipe is delivered to the line in random 80-ft. joints already doped and wrapped. The 7 to 8-ton joints are individually lowered in by a Caterpillar 572 pipelayer and all welds are made in the trench at bell-hole points.

Averaging about 35 bell-holes a day each, three backhoes—a Lorain L-50, Bucyrus-Erie 22-B and Insley WB—cut the holes at an angle for left and right handed welders and to a depth of about 86 inches, 18 inches below the floor of the trench.

Four 572 pipelayers, and a D7 which powers two side-mounted Lincoln Twin-Arc welders, make up the line-up and lowering-in spreads headed by Ken DeShon and Chuck Hughes respectively.

While one 572 lifts and lowers an 80-ft. joint, another pipelayer acts as catch-off on the end of the pipe already in the trench. The latter also breaks space ($\frac{1}{16}$ to $\frac{1}{8}$-in.) to enable welders to place a root bead. At the same time the remaining two 572's leapfrog the line, the one acting as catch-off at the opposite end of the joint, the second

Mojave desert not only conceals rock beneath its sand, but harbors wind storms with gusts up to 80 mph. Wind often refills the open trench with sand, necessituting re-digging.

(Left) Arriving by rail in random 40-ft. lengths, the pipe is double-jointed, coated and wrapped at 20-acre yard near Minneola.

(Right) Pipe bending machine, fed 80-ft. joints by a pipelayer, bends an average of 50 joints a day for relatively flat terrain.

moving ahead to pick up another joint.

To line up the joints for welding, an internal CRC self-traveling line-up clamp is used with 10,000-psi hydraulic jacks for rounding out the pipe. The clamp is held in position until 100% of the root bead is deposited.

Four Welders

Using the two Twin-Arc welders, four men—each with a helper—weld each joint simultaneously, making both the bead and hot pass. By the tenth day, the firing line had reached a pace of 102 joints.

Capping is done by five crews of two welders each using Lincoln welders. Two welders are used instead of one to provide even distribution of thermal stress around the pipe. After the welded joints are wrapped and tested, bell-holes are then partially filled by an International TD-14A and Cat 955 Traxcavator, care being taken to prevent rocks from tumbling down and damaging the wrapping. Approximately 40% of the field welds are X-rayed using the API standard 1104 criteria of acceptability. A holiday detector locates coating and wrapping flaws.

Six crossings will be encountered along the 116-mile route—three below U. S. highway 66 and three below the Sante Fe Railway. Casings of 40-in. diameter protect pipe for both road and railroad crossings, with wall thicknesses measuring 0.344 for road and 0.688 for railroad.

Unlike most pipelines which scale inclines with sharp bends, the PLGS line will undulate gently. This is due to the maximum overbend restriction of ½° per 3½ feet. (Minimum sidebends call for a 150-ft. radius.)

According to Marcus (Buck) Buckland, genial project supervisor for PLGS, pipe bending limitations are necessary because gas coming from the compressor station to be in-

Four pipelayers, and a D7 which powers two side-mounted Lincoln Twin-Arc welders, make up the lineup and lowering-in spreads.

stalled later at the Colorado River will be hot, not water cooled, thereby eliminating the need for an elaborate water treatment plant. The elimination of sharp bends will limit the number of costly anchors which would otherwise be required to control pipeline expansion.

This, of course, raises certain problems. For example, the pipe bending machine, fed 80-ft. joints by a Caterpillar MD7 pipelayer, bends an average of 50 joints a day in relatively flat terrain. But in the hill country ahead, it will bend almost every joint. In addition, cuts along the right-of-way are multiplied both in number and depth. What would normally be a 10-ft. cut becomes a 20 to 25-ft. one to reduce the overbend grade.

Clearing the 100-ft. right-of-way began January 11. By February 15, the crew, led by Ben Mapes, had advanced 41 miles. The desert was benign in spots, for it was possible to clear 12 miles of sand and clay with a Cat No. 12 and a rented Adams 660 motor grader.

Trench Ripped

But the Mojave was less gentle on the other 29 miles. Most of it consisted of decomposed granite, reconsolidated lava and other igneous rock that had to be ripped. This task was assigned to a Cat D9, two D8's and a D7 equipped with Ateco and Kelley rippers. Dozing was carried out by eight D7's and a D6, all equipped with angle blades. The trench itself was ripped by an International TD-24 and Kelley ripper. Ten large cuts, from 15 to 25 feet, and numerous 5 to 8-ft. cuts were encountered in the 41-mile span. In one 5-mile stretch, the material became so hard that the D9 and D8's ripping had to be pulled or pushed by either a D7 or D8. "We broke a ripper shank and a few hoses," Mapes said, "but it was a darn sight cheaper than drilling and shooting."

However, one 8,000-ft. stretch of "new" lava had to be drilled and blasted, a job that took three weeks and some 40,000 pounds of 60% ammonium nitrate. Three Gardner-Denver drills cradled by MD7's, punched holes an average of 8 feet deep, but as much as 12 feet in humps.

Some 25 miles behind the clearing crew and 9 miles ahead of the pipe gang, is a Cleveland 320 ditcher powered by a Cat D315 engine. The unit is gnawing the trench to a depth of 68 inches and width of 44 inches. In rocky areas the ditch is opened by seven hoes, including six B-E 22-B's and an Insley WB. Wind storms with gusts up to 80 mph have twice refilled sections of the trench with sand, which had to be hoed out again. Chet Collins is ditch foreman.

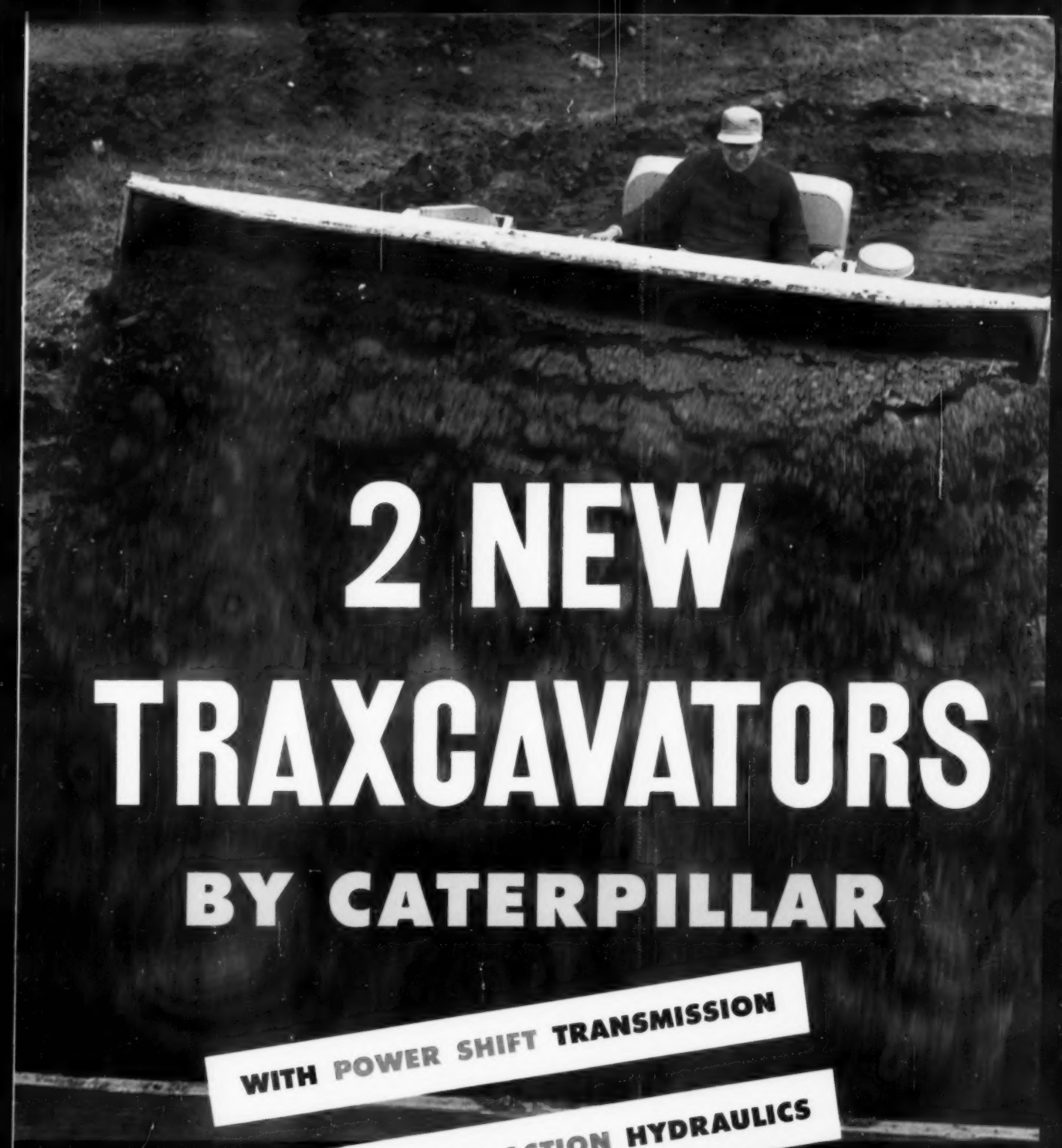
The pipe itself, rolled by Kaiser Steel at Napa, is fabricated in accordance with API 5LX52 specifications with standard 30° bevels at one end. The opposite end has a 3/16-in. land, specially designed for a yard double-jointing operation. Delivered by rail in random 40-ft. lengths, it is double-jointed, coated and wrapped by Pacific Pipeline at a 20-acre yard near Minneola, just off U. S. 66. Three wall thicknesses of pipe are used: .469 inches for the line; .566 for roads and valve installations; and .875 for railroads. Yield strengths range from 70,000 to 80,000 psi.

In the yard operation, directed by Charles Sloan, the pipe lengths are lined up by a CRC lineup clamp and tack welded. It is then welded both inside and out with Lincoln automatic welding heads. Joints are shot blasted with steel nail clippings and immediately primed with Koppers 70B containing a coal tar base. The pipe is coated with Koppers HiMelt bitumastic enamel and a glass reinforcing mat with an asbestos 15-lb. felt saturated with coal tar. The crew of 60 averages 150 joints per 9-hour day. Pipe is handled by four 9-ton and two 12-ton Gerlinger fork lifts.

Stringing is under subcontract to Contractors Cargo Co., Los Angeles. Eight elongated Peterbilt pole trucks, each carrying three joints, are stringing 70 to 100 joints a day, depending on distance. Longest haul from the

Continued on page 53

Using two Twin-Arc welders, crew welds each joint, making both the bead and hot pass. Simultaneous welding will distribute thermal stress uniformly around the 34-in. pipe.



2 NEW TRAXCAVATORS BY CATERPILLAR

WITH POWER SHIFT TRANSMISSION

AND LIVE ACTION HYDRAULICS

977 Series H · 955 Series H

... all new for new high production

FASTER loads . . . lifts . . . hauls . . .

New Cat Series H Traxcavators!

There *is* a way to beat higher costs—and that's with increased production. For tractor-loader jobs, here's your answer in the new Caterpillar 977H and 955H Traxcavators. Designed to set a production pace far faster than the models they replace and any other tractor-loaders of comparable size, they're milestones in tractor-loader progress. With Cat power shift transmission and Live Action Hydraulics, they're machines that never stop. Look at the action pictures here and you'll see why. That's the 150 HP 977H with its 2½ cu. yd. bucket working. The 100 HP 955H with its 1¾ cu. yd. bucket is equally spectacular. Listed here are some of the features that make these machines the fastest working tractor-loaders ever built. For complete details, see your Caterpillar Dealer.

.00 sec.

READY TO GO. With the range selector in low, the operator has only to use the power shift lever for split-second changes of speed and direction. Between the range selector and the power shift lever, the new 977H has 4 speeds forward and 4 faster in reverse. However, for the average job, only the power shift becomes the operating lever. Automatic tilt control has positioned the 2½ cu. yd. bucket for digging.

4.2 sec.

FASTER LOADING. With 150 HP at the flywheel and an operating weight of 36,270 lb., the 977H develops up to 72,000 lb. push at converter stall without stalling the engine—push aplenty to break out big loads. Live Action Hydraulics deliver increased digging power to operate the bucket with greater speed and force for faster loads. The material here is an earth and gravel mixture, up to one inch in size.

13.2 sec.

FASTER HAULING. Using a light touch on the power shift lever to reverse instantly and pick up haul speeds, the operator returns at 4.0 average MPH over a total distance of 48 feet to the truck. Because the new 977H is heavier than the previous model and its center of gravity is 10% further to the rear, it has greater stability to handle with ease the heavier loads in the new 2½ cu. yd. bucket.

dumps . . . cycles!

18.0 sec.

FASTER DUMPING. The 977's bucket reach of 39½" at 9' 4" dump height easily clears this 7' 8" high, 10 cu. yd. truck. With this reach, the operator can cast the load where he wants it without time-wasting jockeying. Automatic kick out on the lift controls further reduces bucket maneuvering time. Dumping completed, the operator moves the power shift lever for instant return toward another load.

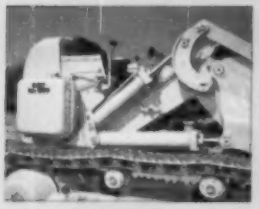
26.4 sec.

FASTER RETURN. With a return time of 8.4 sec., the total cycle time for the 977 was 26.4 sec. In a typical job study, the average cycle time per truck load was 117.6 sec. In 60 minutes the 977H loaded 30.6 trucks with a total of 306 cu. yd. This is typical of the outstanding performance you can expect from the 977H—and, in its capacity, from the 955H. Nothing in their size range can match the Traxcavators that never stop for fast cycles and high production!

NEW POWER SHIFT TRANSMISSION

One lever—that's right, one lever gives split-second changes in speed or direction to slash cycle times and increase operator efficiency. This Caterpillar exclusive was designed especially for the 977H and the 955H.

NEW LIVE ACTION HYDRAULICS



Another Caterpillar first. Live Action Hydraulics provide faster lifting speed and greater lifting capacity without robbing power from the tracks. The 977H packs 41% more hydraulic lifting power—955H, 23% more than former models.

MORE HORSEPOWER WITH NEW CAT TURBOCHARGED ENGINES

Up 50% on the 977H—its new Cat D333 Engine develops 150 HP at the flywheel. Up 43% on the 955H with a new Cat D330 Engine that develops 100 flywheel HP.

NEW INCREASED BUCKET CAPACITY

An 11% increase on the 977H with new 2½-cu.-yd. bucket—and a 16.6% increase on the 955H with new 1¾-cu.-yd. bucket. To handle the heavier loads, bucket linkage on both machines has been strengthened.

NEW HEAVY-DUTY UNDERCARRIAGE

Built to stand up under the toughest jobs, the new undercarriage on both machines features larger, stronger track components that also increase stability . . . lifetime lubricated rollers that need no lubrication until rebuilding . . . and track guiding guards welded to the roller frame for positive track alignment. The 955H also features a new 6-roller track frame.

FAST TRAVEL SPEEDS

977H . . . Forward		955H . . . Forward	
Low	High	Low	High
2.0 MPH 1st	2.5 MPH 1st	2.1 MPH 1st	2.7 MPH 1st
3.6 MPH 2nd	4.7 MPH 2nd	3.9 MPH 2nd	4.9 MPH 2nd

Reverse speeds 25% faster than forward

MORE HIGH PRODUCTION FEATURES

Other features on both machines include a new, two-cylinder high-speed gasoline starting engine for positive starts in any weather . . . and a new, dry-type air cleaner that removes 99.8% of all dirt from intake air even in the worst dust conditions, cuts maintenance time as much as 75%. Retained features include 40° bucket tilt back . . . automatic bucket positioners and kick out . . . 3-grouser track shoes . . . and quick-change attachments that multiply the machines' usefulness.

PACE-SETTING POWER PLUS VERSATILITY

in the new Cat Series H Traxcavators

SIDE DUMP BUCKET Directly interchangeable with the standard bucket, the side dump bucket provides increased versatility for Series H Traxcavators. It eliminates turning and requires less loading space – to sum up, lowers cycle times for even greater production. Capacities: 977H – 2⅝ cu. yd.; 955H – 1¾ cu. yd.

You've seen how increased horsepower, power shift transmission and Live Action Hydraulics make the new 977 and 955 Series H Traxcavators the fastest working tractor-loaders in the field. That means higher production for you not just on one job application, but on many—because of the many attachments available with both machines. Bar none, Traxcavators are the most useful machines you can own. With attachments, you can always keep them working—and working *profitably*.

Have you checked your equipment line-up recently? There may be machines in it that are no longer paying their way—or not earning *all* the profits they should in light of today's more efficient units. A comparison of your existing tractor-loaders with the new Series H Traxcavators might easily prove these new machines would increase your output and profits far more than you imagine.

Get the down-to-earth facts about the new Series H Traxcavators from your Caterpillar Dealer. Better still, ask for a demonstration. See for yourself how they set a new production pace on the toughest kind of job!

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

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BORN OF RESEARCH PROVED IN THE FIELD

Shading machine was developed on the job as a dirt separator in backfilling. It consists of a Cleveland 240 ditcher and a gravelshaker. The ditcher cuts a shallow trench and feeds material to the shaker, which sifts and shoots a stream of fines.

Mojave . . .

Continued from page 48

Minneola yard will be about 68 miles. But when the yard is moved to Henderson, Nev., the haul will reach a maximum of about 115 miles. Stringer trucks will eventually total 15. Along the right-of-way, pipe is unloaded by a Michigan 275A with padded logging clamp. A Cat MD8 pipelayer unloads the stringer trucks in rough terrain.

In addition to the foremen mentioned, Erlewine is assisted by Hank Jennings, bell-holes; Jay Warnick, bending; Andy Bisby, doping; N. C. Dupy, valves and tie in; Joe Denton, chief mechanic; Sam Nord, materials; and Emery Heagney, office manager. Leo Leoffler is equipment supervisor.

Twenty PLGS people are serving as inspectors under Supervisor Buckland. Foremen include A. W. Uhl, right-of-way, crossings, stringing and bending; Gene Allen, welding; and Russell Cash, joint coating, shading, backfilling, cleanup and testing. Chuck McKinnon and Paul Evans are in charge of the double-jointing and yard coating operations. Frank Whipple is project engineer.

The road ahead is strewn with potential "snake eyes" for Erlewine and his men. Some 40 miles beyond lies Foshay Pass, where a cut 30 feet deep and 1,500 feet long must be made in granite and iron ore bearing rock. Beyond lies four miles of rugged terrain. Finally, near the eastern end of the line are the Providence Mountains where the pipe will rise to a height of 4,200 feet and drop to about 500 feet at the Colorado River. It's a gamble all the way.

Cat D6 tractor with angle blade backfills the trench after pipe has been shaded. Protective layer of fines left by the shader on the bedded pipe can be seen in the foreground.

Spread Supt. Lee Erlewine (left) is shown with Leo Leoffler, equipment supervisor.

Smart Shooting Pulls Boxed-in Cuts Safely

With houses and highways never more than a stone's throw away, a mountain road has blasting problems. Shots with a fertilizer explosive insure safety and help keep costs in line.

MOUNTAIN climbing comes high—in cost and complexity—for road builders around Birmingham, Ala. Ask A. E. Burgess Co. The local contractor low-bid the job of straightening out a ski-slope access highway to the city. Only a clever way with difficult rock cuts kept the low bid from becoming a disaster.

Burgess had a rough time trying to pull production-scale shots within stone's throw—literally—of adjacent homes and passing cars. Science and smooth-acting low-velocity powder helped lick the problem and helped keep costs in line, too.

Like all highways entering Birmingham from the south, the Green Springs extension jumps the hurdle of Shades Mountain before it dips into Jones Valley, where the main city lies.

Poor Visibility

The narrow road corkscrews down the mountainside with grades up to 20%. On the slope there is hardly a spot where you can see more than a car's length ahead.

Commuters from the city's highland suburbs, and truckers shortcutting to the Birmingham expressway know this road's twists and turns well. They look forward to the $1 million double-barrel dream highway that will replace the nightmare route. Burgess shares their anticipation.

Jim McCoy, job superintendent, watches a long queue of cars crawl upgrade behind a lugging semi-trailer. He points out a rugged crag towering alongside the road.

"We have to pull out 95 feet of rock there," he explains. "It's the biggest cut on the job—and the toughest, too. We are squeezed between the road below and the houses on top of the hill."

McCoy swings his pick-up into the stream of traffic. Beyond the crest of the hill a solid rank of trees at the end of the cleared strip shows where his contract ends. The new right-of-way parallels, then crosses the existing pavement.

Now the pick-up gains speed as the old road dives onto the slope. McCoy downshifts to second gear to keep control on the asphalt bobsled run. The throbbing growl of a diesel engine on the rocky cliffs above, where a shovel tears at the mountain's backbone, is the only indication of work.

Shovel scores a bulls-eye with 2½ yards of shot rock in wide-open bed of an International 95 Payhauler. Coming up in the background, another truck climbs up a 30° slope.

(Above) Pair of dozers stockpiles overburden for later use as cover on the rock fill. They work deep in muck as they clear areas where the rock traps runoff water.

(Above) Rubber-tired Michigan front-end loader draws the cleanup assignments. The big rig loads out debris, and polices the haul roads and highway for rock and dirt.

This is the big side-hill cut McCoy had pointed out before.

Midway down the slope, the old and new roads cross again. Dozers here open dull red wounds in the clay-loam overburden to set the stage for drill crews. A 30-ft. cut will pass the road through this rocky spine.

McCoy shows off some profit-winning know-how as he details the work sequence.

"We saved this cut for last," he explains, "because it's handy to the fill. Dirt from this overburden will blanket the rock in the embankment. We avoid rehandling of the dirt, or long hauls to bring it in from stockpiles, by waiting on this cut till we're ready to top out the fill."

Yes, he said fill. For the terrain at the foot of the slope looks more like tidewater than mountain country.

"This was a lake till we blasted out the dam and sliced open a channel," McCoy relates. "Now we have a subcontractor putting in a bridge. There will be 30-ft. high fills on the approaches."

Although cut-and-fill quantities on the job balance, the terrain tosses a mean curve at Burgess. The cut is all at one end of the contract; the fill all at the other end. McCoy estimates the job will run up almost a half-million overhaul units. (The bid set-up provides for 1,000-ft. top haul on the unclassified excavation item. Overhaul is paid on the number of yards hauled beyond this limit, and the distance the material has to be moved.) But overhaul is no contractor's windfall. The long, steep hauls made choice of haul units by Burgess more critical than usual.

Dig Pockets

McCoy guides the pick-up around an off-road truck parked out on the pavement edge. A Northwest dragline dumps black globs of muck into the hauler. The only distraction in this swampland vignette is a chattering Ingersoll-Rand crawler drill sinking shot holes in a rock outcrop almost in the shadow of the dragline. Rock and muck share a common bed on this job. In fact, the contract section from mountain rock to valley marsh, stretches just 1.7 miles. In that short distance a dizzy 400-ft. drop in elevation adds to job hazards—and job problems.

No phase of the contract brings out the hazards and problems more clearly than the excavation work. Hemmed in by the busy road on one side and nearby houses on the other, the deep cuts test the skill of blasters and digging crews alike.

The contract calls for 400,000 bank yards of unclassified excavation. This is running about 60% rock—slightly less than pre-job borings indicated. But the perverse rock allows no bonus on the bid price. Burgess counted on 20% swell when they figured fill qualtities. Job records show it is coming out closer to 10% shrinkage.

A hustling team of short-haul dirt-movers strips overburden from the

Powder men spill ammonium nitrate prills into a shot hole. Fertilizer is safe to handle and store even on a job like this.

cuts. A Caterpillar D8 dozer, with two rippers on its tail-mounted tool bar, opens the tight clay-streaked earth mantle. Then a Cat D8-drawn No. 463 scraper loads out the dirt to stockpiles or nearby fills. The crawler-drawn pan takes rough ground and tight turnarounds in stride. The crew clips minutes off cycle time by push-loading the pan with the dozer between ripping passes.

McCoy takes no chances with uncontrolled blasting in the pinched areas. He plans every shot—and insures his planning with scientific field checks. Insures is right. The blasting control is a bonus service of United States Fidelity & Guarantee Co.

Engineers from the insurance company surveyed the area before the first dozer moved in. They checked every building within shooting range for existing defects. Charts plotted every plaster crack, every loose brick. They left no opening for damage claims after blasting began.

Then the engineers ran a series of seismic tests to set the safe powder level. With sensitive gauges they measured the force of ground shock from each trial shot. The test results gave McCoy an easy-to-use yardstick for safety on every blast.

Although a crawler drill handles light shooting tasks on ledges and slope clean-up, most shot-hole work goes to McCoy's big gun—a Winter-Weiss Portadrill mounted on a D6 tractor. Even on the roughest cuts the crew sets up shop in minutes. They waste no time dragging along and hooking up compressors. Air power for drilling rides pick-a-back on the tractor with this self-contained unit. With the drill on target, the workers use the rig's built-in hydraulic muscles to raise the mast, which folds forward in travel for safety and better balance.

The 7⅜-in. diameter carbide-tipped bit chews through the sandstone and shale bedrock at a rate averaging a foot a minute. The crew sinks 28-ft. deep holes to pull a 25-ft. lift. Hole pattern varies somewhat according to distance from sideslopes, but most shots are planned on a 12x12-ft. grid.

Nitrate Prills

Dry holes are shot with Lion Brand ammonium nitrate prills. The easy-to-handle blasting agent gives top-notch breakage at low cost. McCoy rates it high, though, because it can be stored anywhere on the job without special precautions (except, maybe, protection from farmers looking to pick up some extra fertilizer).

For safety's sake, hole loading on shots close to houses is limited to 2,000 pounds of nitrate. This works out to a pattern of three holes wide, three holes deep. Hole loading is fast and easy. The men weight a string of Primacord and unreel enough to reach the bottom of the hole. Then they slit an 80-lb. bag of prills and pour the

Sinking 28-ft. deep holes in sandstone and shale, a Portadrill prepares the cut for shooting. It drills 7⅜-in. diameter holes.

Stripping overburden, a D8 in foreground handles ripping and pushloading, while a Cat No. 463 scraper hauls to spoil area.

Even in a swampy area, rock is close at hand. A 1½-yd. dragline clears out a muck pocket while a crew drills a rock outcrop.

contents into the hole. The average hole takes two sacks of nitrate.

By pouring 1 to 1½ gallons of diesel oil into each hole, the powder monkeys boost the burning rate of the nitrate to a point where it becomes an effective explosive. The Primacord detonates the column.

About 15 feet of dirt stemming tops each hole. The men tape caps to the Primacord for electrical detonation. Delays up to No. 4 (pulled away from the bank) improve breakage and prevent excess rock throw.

How effective is the nitrate? Well, powder ratios run very low—about ¾-pound of prills per yard of rock. With high blasting force at the cost of fertilizer, the nitrate shapes up as a real bargain.

Shot rock gets fast handling from McCoy's loading shovel—a Bucyrus-Erie 54-B. The rock-eating rig works close under the face of the cut. The operator crowds the 2½-yd. dipper into the broken rock, using dirt from the toe of the cut to cushion the bright metal wherever possible.

Working a tight 90° swing, the shovel loads out 2,500 yards of rock each 11-hour shift. The crews work two shifts a day.

Haul trucks have no milk run here. Guiding the fully loaded hauler down rough-graded slopes and through busy intersections puts a lot of strain on drivers—and trucks too. The deadhead leg of the cycle is all upgrade, at mountain-goat slopes.

Short Haul

Knowing that balance of haul power to shovel power prevents profit leaks, McCoy put four International 95 Payhaulers on the run. At top haul distance (about 1¼ miles) this fleet is just the right size to keep a truck under the shovel at all times. When cycle distance shrinks, McCoy moves one or more of the haulers onto other chores. That is when you see them spoiling muck or hauling in dirt for shoulder dressing.

The Green Springs extension highway is a Jefferson county project. However, it will eventually be part of the urban highways system as a feeder to Birmingham's interstate loop.

Beside trailer office are Supt. Jim McCoy (left), and Joe Rodgers, his assistant.

M-K's rig consists of a trencher and conveyor-screen unit that separates fines from the coarse material, and backfills the trench.

Trencher Digs Ditch, Backfills Simultaneously

Equipment train put together in the shop of a contractor somewhat resembles a "Major Hoople" contrivance—but it really works! It digs the hole and backfills all in one operation.

RUNNING a major sewer job right in its home town of Boise, Idaho, Morrison-Knudsen Co., Inc., has come up with a unique trenching idea to speed the far-flung sanitary system project. M-K is using a pair of special trenching rigs which backfill the ditch as they dig and crawl forward. Each one of these rigs has laid down as much as 625 feet per day of completed sewer (not trench alone), despite difficult digging conditions.

The hybrid rigs were specially modified in the contractor's local shops for the Boise Bench Sewer System project. The $4 million job includes 92 miles of mains and laterals and some 40 miles of service-connection lines. All pipe is concrete. The Boise "bench" is a broad plateau-like area along the southern rim of the city. The bench was once farm and pasture land, but with the boom in housing it has blossomed into a large residential and commercial district.

Public sewage service is now being provided to the recently developed area by the Bench Sewer District of Ada county.

Portions Sublet

M-K's trenching rigs are being used on about 35 miles of the sewer job; the remainder of the 132-mile job is subcontracted to Valley Construction Co., of Seattle, Wash., which has been associated with Morrison-Knudsen on

Subsoil is an unstable mixture of sand and cobble rock. When photo was taken during freezing weather last winter, walls of the trench were caving under the frost shell.

many sewer jobs in the Northwest. The subcontractor is working with backhoe and dragline equipment.

On most parts of the job there are several feet of soil above a hardpan strata, with an unstable mixture of sand and round cobble rock beneath the hardpan. The sand and cobble rock invariably cave up to the hardpan strata; and in places where the hardpan has been removed for street cuts or for some other reason, the trench usually caves all the way to the top. At times the 12 to 16 inches of frost in the ground when trenching was started last winter proved to be a blessing by keeping the caving from reaching the surface.

To handle the caving, and to fulfill the contract specification calling for the fine material to be separated from the coarse and put down on the pipe first, Morrison-Knudsen has come up with a fresh idea in deep sewer line trenching. Two Parsons 310 ladder trenchers powered by 83-hp Caterpillar diesel engines are being used to dig the 9 to 20-ft. deep main line trench on M-K's section of the job. Each trencher pulls along with it a shield to protect the pipelayers in the trench from cave-ins, and a specially built conveyor-screen unit which separates the excavated material, puts the fines on the pipe first, and then backfills the trench—all in one operation.

Safety engineers and the Boise police and fire departments like this quick backfill because streets can be quickly opened for one-lane traffic if an emergency vehicle has to get through. Homeowners benefited because their driveways weren't blocked for more than an hour or two, and because they could get fuel oil deliveries during the cold weather.

Another advantage of the trenching operation is that it minimizes the pavement restoration problem. The trenchers only cut a 39-in. hole into the asphalt pavement, while backhoes, which must slope the banks of the trench, rip up the pavement to widths of eight feet.

Power poles, too, are less of a problem in the trenching operation. When a hoe is used, it must dig 10 to 20 feet of trench to grade before the shield that protects the workmen from cave-ins can be skidded forward.

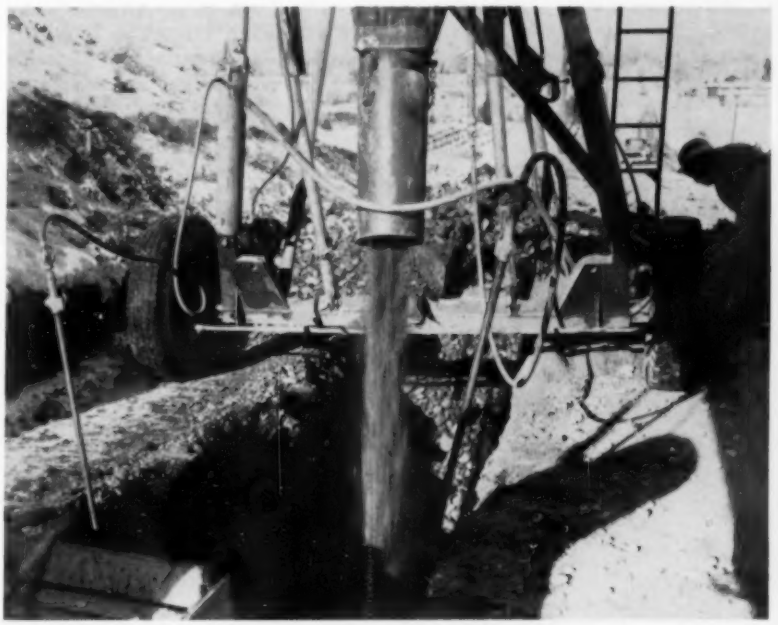
The trenching rigs, which pull the shields right along as they dig and backfill as soon as the pipe is laid, leave so little ditch open at a time that there isn't much danger of a pole falling.

Sections Added

The protective shields are 18 feet long, and taper from a 39-in. width at the front to a 36-in. width at the rear, so that they will pull easily through caved-in material. They come in 4-ft. high sections which bolt on top of one another. By adding or removing sections, the height of each shield can be matched to the depth of the trench in which it is being used.

The shield sections are open at the front, except for cross bracing, and at the top and bottom. The sides and backs of the sections are made from $\frac{3}{16}$-in. steel plate braced longitudinally and transversely with angle iron. Built onto the longitudinal braces are pockets in which 4 x 4 timbers can be placed crosswise to the trench for

(Above) Screen end of conveyor-screen unit straddles the trench for backfilling. (Below) Projecting from a hopper underneath the screen is an "elephant trunk" which directs fines onto pipe in trench. Pneumatic tampers in foreground pack the fines around pipe.



additional bracing, if they are needed. On the bottom section of each shield, the lower half of the back is left open to clear the pipe in the trench, and a dozer-like curved steel plate two feet high is welded across the front to serve as a crumber for the trencher.

A series of brackets for securing towing chains is fastened on the front of each shield section, and as the trench gets deeper or shallower, the towing chains are moved to the proper pair of brackets to get a level pull on the shield. At the other end, the towing chains are secured to special carts towed by the trenchers.

Each of these special carts has two telescoping arms connected at the rear by a piece of angle iron fitted with chain brackets, and is mounted on a set of wheels which straddle the trench. At the front, the arms of the cart are chained to a heavy plate welded to the main frame of the trencher which does the towing. The telescoping arms are used to adjust the distance between cart and trencher. In this way, the shield can be kept close enough to the digging boom to prevent material from caving into the trench ahead of the shield, no matter what the depth of the trench or the angle of the digging boom.

Even more ingenious are the conveyor-screen units built by Morrison-Knudsen for separating the fines and backfilling the trench. The main components of each unit are a 60-ft. long conveyor to carry the spoil up and back from the trencher, and a 3 x 8-ft. shaker screen with a rod deck to separate the fine material from the coarse. The fines drop into a hopper, at the bottom of which is an adjustable "elephant trunk" which directs them into the pipe in the trench. Coarse material slides off a short chute at the back of the screen and goes into the trench on top of the fines.

At the beginning of the job, the conveyors and screens were powered by air-cooled gas engines and an operator was needed to tend them. But before long, M-K replaced the gas engines with electric motors and eliminated the operator. Power for the electric motors is furnished by a General Motors 20-KW AC120-240 generator set mounted on the front of each trencher in place of a counterweight.

Conveyor Mounting

Each of the conveyor-screen units rolls on two sets of wheels, one set at the front of the conveyor and the other set on a special undercarriage beneath the screen. The rear wheels are mounted on a 10-ft. axle and, ordinarily, straddle the trench. The wheel-axle assembly is equipped with hydraulic steering so that the back end of the conveyor-screen unit can be guided around cave-ins.

If a cave-in is too wide for the wheels to straddle, a crane picks up the back end of the unit and sets it out in the middle of the road until the caved area is passed.

The conveyor-screen units are towed from special hitches near the front of each trencher. One of these hitches is located on each side of each trencher so that a conveyor-screen unit can be placed on whichever side of a trencher is more convenient. The hitches fold back out of the way when they are not being used. The conveyor-screen units' receiving hoppers, into which the trenchers' conveyors feed the spoil, are set in stake pockets so that they can be reversed when a conveyor-screen unit is moved to the opposite side of a trencher.

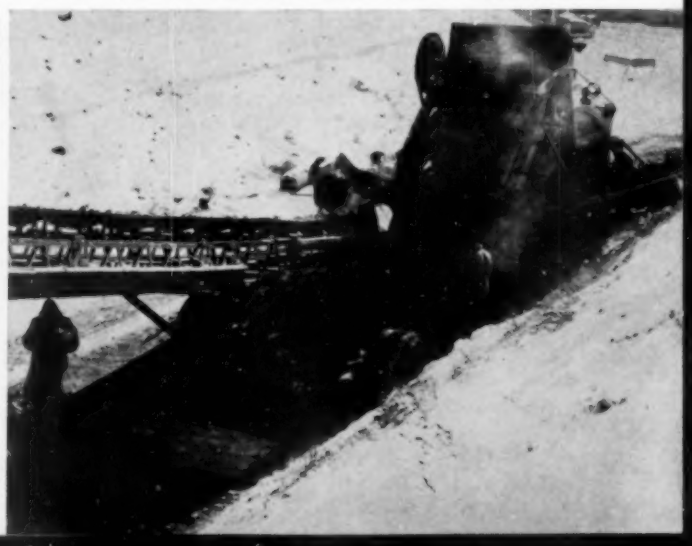
Concrete pipe used on the job varies from 36 to 8 inches in diameter. It is strung beforehand by the contractor. Largest pipe being laid with the trenching rigs is 18-in. size, although it would be possible to lay larger pipe by using a wider cave-in shield. The 15-in. and larger pipe is central spun and comes in 10-ft. lengths, while the smaller pipe is bell and spigot type in 4-ft. lengths. Rubber ring seals are used at the joints, and lubricated so that the joints slide together easily.

A Coffing hoist running on a rail under the conveyor is used to lower the 4-ft. lengths of pipe into the trench. When the conveyor-screen unit is not straddling the trench, a rail to carry the small electric hoist is mounted on a mast arm which is fastened on the shield.

The larger 10-ft. lengths of pipe are picked up and lowered into the trench by an Austin Western 220 hydraulic crane powered by an Allis-Chalmers diesel.

The only modifications Morrison-Knudsen had to make on the trenchers for the Boise job were the hitches for the carts which tow the shields and for the conveyor-screen units. No modifications were necessary in the power plants, power trains or tracks of the trenchers to handle the additional loads. Cost to Morrison-Knudsen for fabricating the conveyor-screen units and the shields and carts was about $35,000.

(Left) Cart that tows the shield is chained to a special plate welded on the main frame of trencher. (Right) Telescoping arms allow the distance between cart and the trencher to be varied according to depth of trench and angle of digging boom.

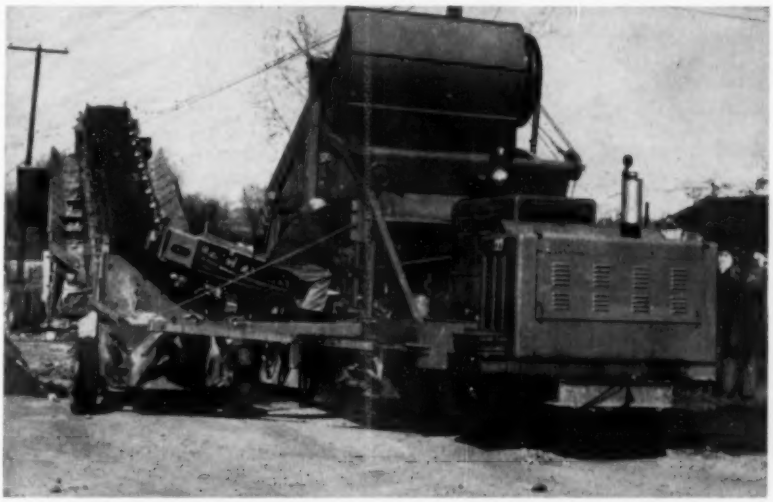


A 4-ft. high section is added to the shield in the trench. When bolted in place it will raise total height of the device to 12 feet.

Most of the time, a 9-man crew is used for each trenching rig. In addition to the foreman and the trencher operator, there is an oiler who tends both the trencher and the conveyor-screen unit; a hoist man to lower pipe into the trench; two pipelayers and a man to run the pneumatic tamper in the trench; an engineer to handle the instruments and run grades; and a laborer to handle the level rod, assist in moving the rig and take care of any odd jobs.

Besides the trenching rigs, M-K equipment on the job includes two Ingersoll-Rand 125 air compressors to supply power for the pneumatic tampers; two Michigan loaders to push extra backfill into caved-in sections of the trenches and clean up excess spoil; a Ford tractor with a front-end loader to clean up driveways; and a Koehring 305 truck hoe to set manholes.

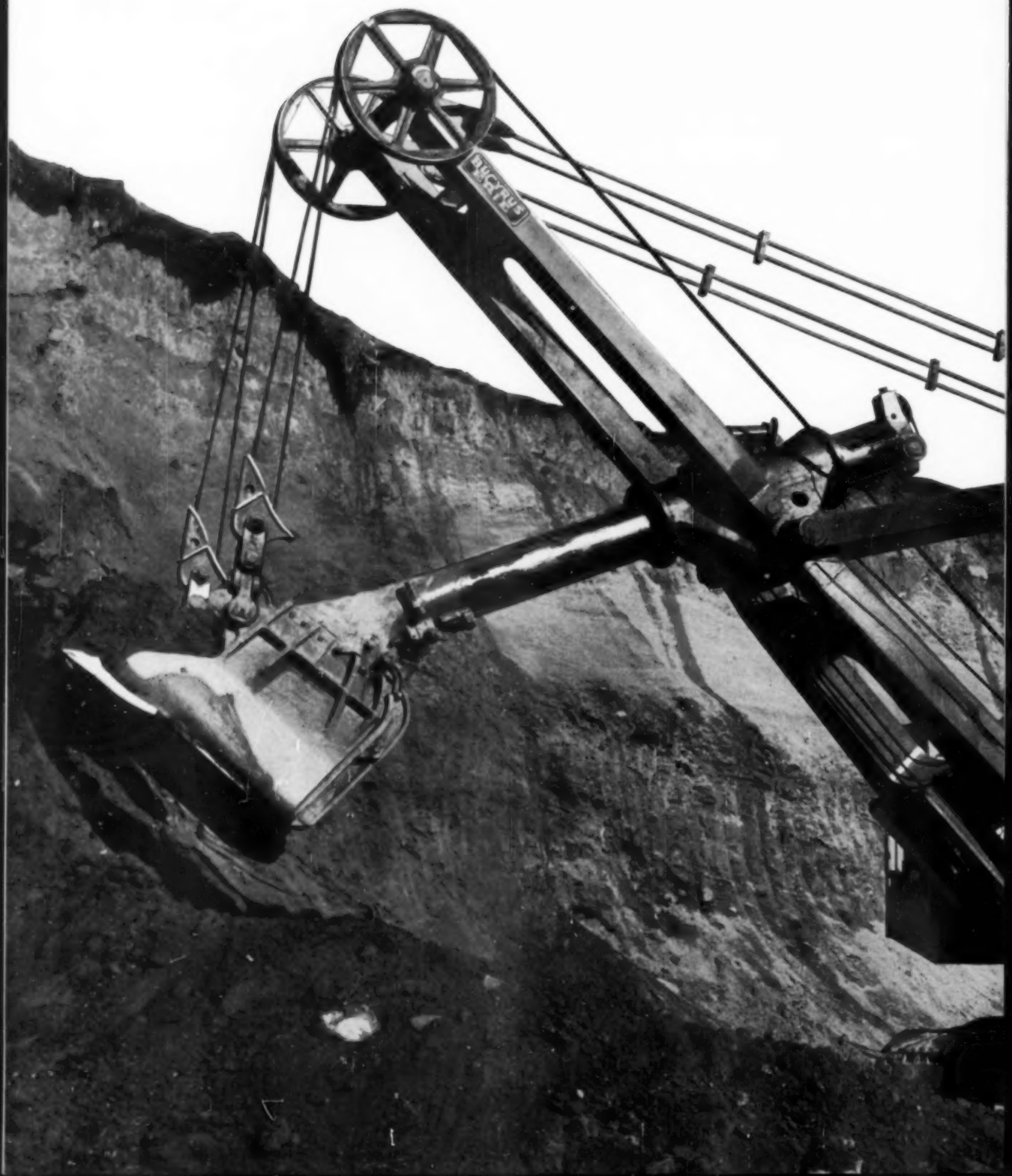
Job superintendent for Morrison-Knudsen is Russell Healey. Donald Smith is assistant district manager for the Boise area, and J. A. Harker is western states district manager.



General Motors 20-KW AC120-240 generator set, mounted on front of trencher in place of a counterweight, furnishes power for electric motors which drive conveyor and screen.

Coffing electric hoist, mounted on rail under the conveyor, lowers a 4-ft. length of pipe. (Right) Men inside the shield have adequate working room.

going big?.



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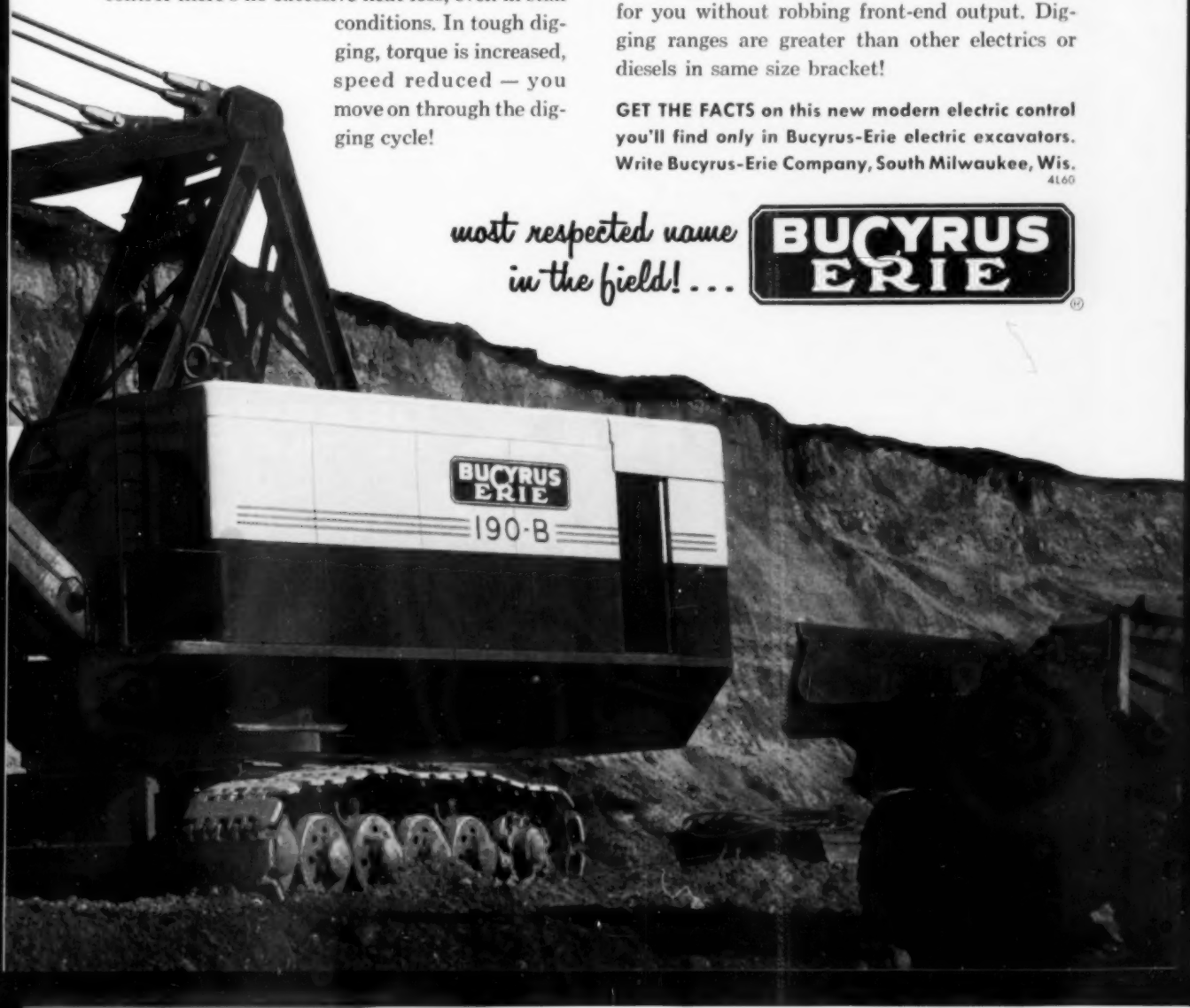

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JOE'S PLACE
"YOU DIDN'T HAVE TO TAKE A SHORT CUT THRU THERE."
"I THOUGHT THIS NEW SURFACING WAS SUPPOSED TO BE JOINT-FREE!"

EXCAVATING ENGINEER

Earthmovers Face-Lift Virginia Farmlands to Build Jet Airport

Big excavation and paving show readies site of world's first major airport designed specifically for commercial jet aviation. Major contractor is C. J. Langenfelder & Son, Baltimore, Md.

WASHINGTON'S John Foster Dulles Airport—also known as Washington International airport, and just plain Chantilly airport—represents one of the most extensive earthwork projects in the eastern United States in recent years.

The jet facility is being built 23 miles due west of the nation's capital on a huge site in Virginia's Fairfax and Loudoun counties. It is located on U. S. route 50 west of Chantilly, Va. Construction funds of some $85 million are being provided by the Federal Aviation Agency, Washington, D. C. The FAA is headed by former Air Force Gen. E. R. Quesada.

The airport will be the world's first designed and built from scratch for commercial jet aircraft. Mobile passenger lounges will be used to carry passengers between planes and the terminal building. The FAA plans to finish the project by mid-1961.

Airport Inadequate

The basic reason for Dulles International airport is that the existing National Airport along the Potomac River is very close to saturation and by 1965 would be unable to handle anticipated increases in traffic.

Estimates which FAA has drawn up for the new airport show that the number of passengers forecast by 1965 is 4 million; by 1970 6 to 7 million; and by 1975 8 to 10 million.

The project involves clearing and grubbing almost 10,000 acres, including the removal of 300 structures scattered over the rolling timber and farm area; the excavation and placement of 11 million cubic yards of unclassified material; the installation of 73,000 feet of concrete pipe, 18 inches to 78 inches in diameter; and the excavation of three large drainage channels.

The cost of clearing and grubbing alone ran close to $500,000. The contract for grading and drainage for Runways 1 and 2 totalled $5,850,000. The third contract—grading and drainage for Runway 3, and the laying of 1,650,000 square yards of pavement for all three runways—went for about $12.5 million. These three contracts, totalling $18.8 million, were awarded to C. J. Langenfelder & Son, Baltimore, Md.

At the present time, the earthwork and sewer installations have been completed, and concrete paving work is in advanced stages.

The project called for no severe cuts or fills, but a layer of unusually tough shale underlays a major portion of the area. Beneath a 6-in. layer of topsoil were some three feet of clay. Below that was the shale bed, varying in density from soft to extremely hard.

The shale generally proved to be rippable, and almost three million cubic yards were broken up by Cat D9's using Cat double-tooth or Sheppard single-tooth rippers. The rippable shale was broken up in 6-in. deep passes. Fractured shale was then

D9 dozer with Caterpillar double-toothed hydraulic ripper completes pass over the deep shale bed that underlay much of project. Passes were made to depth of 6 inches.

Euclid loader was effective in handling ripped shale. Here waiting Euc bottom dumps are loaded with the fractured material. Shale in foreground gives idea of difficulty.

removed mostly with twin-engined Euclid TS-24's, often tandem push-loaded.

An earthwork production rate of 50,000 cubic yards per day was accomplished by a variety of earthmoving equipment, including 42 Cat D8's and D9's, two Euclid TC-12's, three Allis-Chalmers HD-21's, nine Cat DW20's and DW21's, six Euclid TS-24's, 35 Euc bottom-dumps, and nine Cat No. 12 motor graders. Excavators included two Bucyrus-Erie 38-B's, five Northwests, a P&H shovel, a Lima Paymaster, a Michigan tractor-dozer and two Euclid loaders.

The drainage system outfalls into three open channels. One of these, also used as a stream diversion channel, necessitated 700,000 cubic yards of excavation. It is 6,500 feet in length and has a top width of 30 feet. Another of these three channels is almost three miles long and up to 60 feet wide.

Much of the ditching was through tough shale that called for blasting. An Ingersoll-Rand Drillmaster with a 6½-in. rock bit was used for the largest holes along the center of the channel alignments, sinking on the average 30-ft. deep bore holes. These were loaded with a combination of duPont free-running Nilite and Red Cross extra. Additional bore holes, 3½ inches in diameter, were drilled outward from the channel center with smaller Ingersoll-Rand and Gardner-Denver wagon drills. Shots were capped with MS delays, increasing in time lag outward from instants along the centerline.

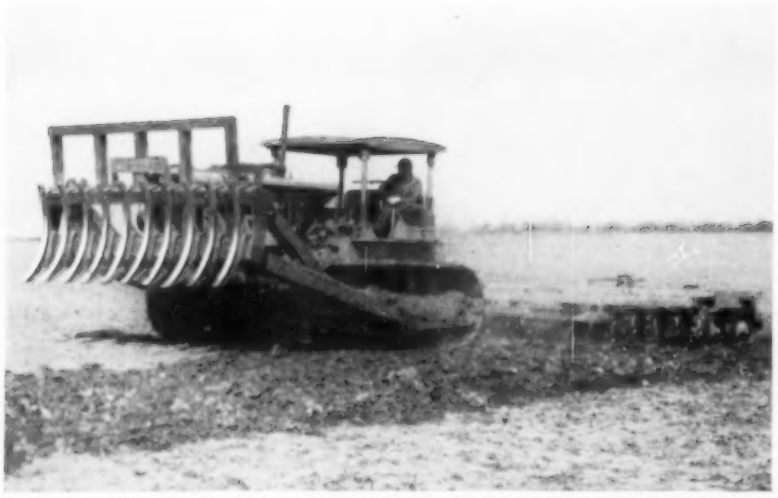
Almost the entire yield from cut areas was used as satisfactory fill, and was compacted to 90% density except under pavement areas where 98% was required. Compaction was undertaken mainly by 16 Tampo double-drum, tractor-drawn sheepsfoot rollers. Additional compaction equipment included four Buffalo-Springfield Kompactors, six J-12 vibrators, three Essick steel rollers, nine Tampo 50-ton rubber tired rollers and one 100-ton rubber tired roller.

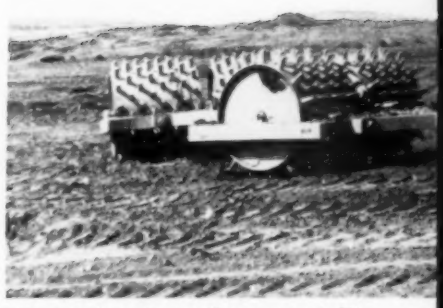
Earthmoving Pace

By using a large fleet of high-production equipment, keeping downtime to a minimum through careful maintenance (some of it was sub-contracted), and through close field management, the Langenfelder firm was able to maintain its 50,000 cubic yards daily earthwork production rate. In one five-month period at Chantilly, five million yards of earth and shale were moved by this major eastern contractor.

Runways and shoulders at the site are equivalent to approximately 115 miles of two-lane highway. Runways consist of from 12 to 15 inches of Portland cement concrete laid over a 9-in. base of crushed stone. Shoulders

Sections of big-diameter concrete drain pipe are lowered into place in the trench by a 38-B, one of two on project. In all, more than 13 miles of storm drains were placed.





(Left) Rome discs aerate the soil where fills exceed 4 feet. (Right) Tandem double-drum Tampo sheepsfoot rollers compact fills.

have a 2-in. topping of asphaltic concrete over four inches of crushed stone.

Design of the airport provides initially for the construction of two parallel north-south runways, each 11,500 feet long—and separated by a distance of 6,700 feet. Another runway, facing roughly southeast-northwest, will be 10,000 feet long. High-speed taxiway turn-offs are built at various exit points.

Each runway will be 150 feet wide with 25-ft. shoulders, and strong enough to support a 500,000-lb. aircraft. Purpose of the shoulders outside the regular 150-ft. width is to provide a surface that can be kept clean to prevent overhanging jet engines from picking up dirt, dust and foreign objects from the ground.

Dulles International's runways will compare with other major airports in this fashion:

AIRPORTS	RUNWAY LENGTH (Maximum)
Washington National	6,700
Idlewild (New York)	11,000
Los Angeles	10,000
O'Hare (Chicago)	8,800
Dulles	11,500

The airport's terminal area will be located in the wide expanse between the two parallel north-south main runways. No hangars will be built during the initial development of the facility. However, adequate provisions have been made for them in the airport master plan.

Concrete Work

Following the completion of the major portion of the earthwork, Langenfelder set up a 450 cubic yards per hour concrete plant on the site; brought in a fleet of 25 White trucks with Dumpcrete bodies; and then proceeded to set an eye-opening pace in pavement placement. In two months, the 450,000 cubic yard project was one-fourth completed, and the average daily placement was in excess of 4,000 cubic yards.

Mixing this vast volume of concrete were three 10-yd. T. L. Smith tilting mixers mounted on steel towers. Sand and aggregates came from three stockpiles, each of which fed a 30-in. conveyor that delivered the material to a semi-automatic Noble batching plant.

Planning Saves Footsteps

IF there existed an average passenger among the 48 million who enplaned during 1958, he walked from his parked car about 650 feet to the ticketing counter, and from there about 950 feet to his airplane.

This adds up to about five times the length of a football field.

Progress Made

Some forward steps in passenger convenience have been made, however. One device, known as the "aero-bridge," is a simple one. The pilot jockeys his plane close to the terminal building's loading. "finger." Inside the building, an operator then extends a kind of horizontal jack-in-the-box out to the doorway of the aircraft. The passenger walks from the finger through the passageway into the aircraft.

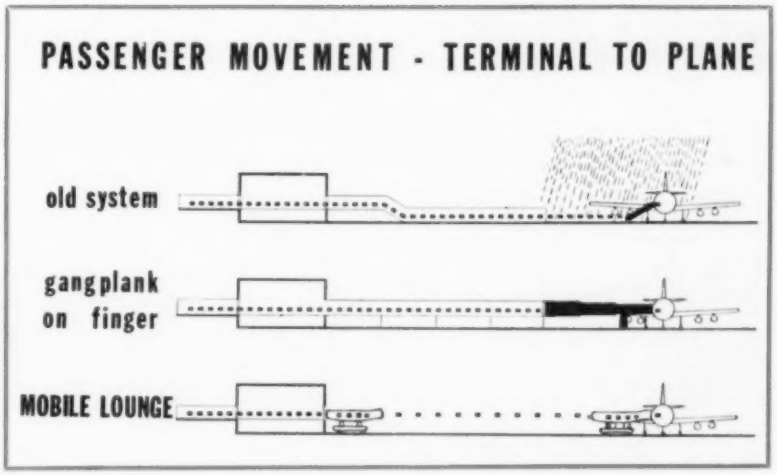
This ingenious device offers the passenger protection from blast, noise, fumes and weather. But, it does nothing to halt the horizontal creep of the growing airport and reduce walking.

So, the designers of Dulles airport sought a new solution—one which would arrest airport sprawl, provide enclosed passage and—most of all—reduce walking to a reasonable distance.

A new "mobile lounge" concept of transporting airline passengers between the Dulles terminal building and parked aircraft has been adopted.

Such transportation is not of itself a new idea. European airports in such cities as London, Paris, Amsterdam and Frankfurt utilize buses to perform this function. This is the first time, however, that a special vehicle has been designed.

The mobile departure lounge will stand on cushioned stilts and wheels. Measuring about 15 by 60 feet, it will accommodate 80 passengers at second-story level. It will load from either end like a ferryboat, eliminating the need to turn around.



Use of the mobile lounge at Dulles airport reduces passenger walking to a reasonable distance and eliminates climbing stairs. It also cuts down size of the airport plant.

A 600-barrel cement bin, fed from two 7,500 barrel storage silos, supplied the cement. Batched material was delivered to the three mixers on 60-in. conveyors.

A 20,000-gallon water storage tank, fed by two 800-ft. deep, 8-in. wells, supplied water to the mixers.

After three-minute mixing cycles, each of the big mixers dumped its contents into a 20-yd. hopper. The Dumpcretes picked up loads under these hoppers. Hauls to the paving and finishing spread averaged about three miles.

Runway pavement was cast in 25-ft. wide lanes. The largest single one-day output was the paving of some 4,000 feet of 25-ft. lane width.

The Dumpcretes unloaded into the hopper of one of two Maxon spreaders that distributed the concrete evenly over the width of the lane in two lifts. Following the spreaders were two Jaeger double-screed transverse finishers. Vibrators on the rear spreader and the front finisher consolidated the material.

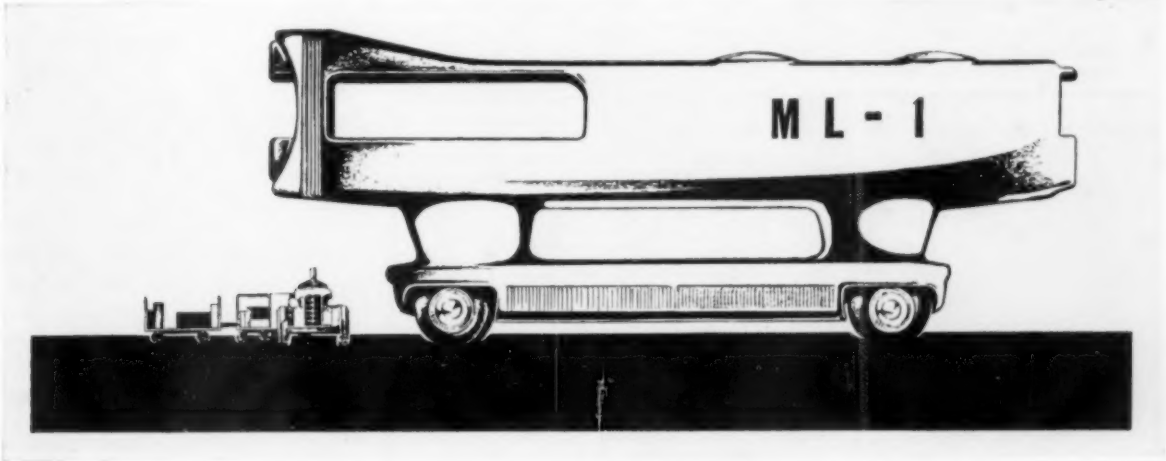
Build Roads

Bringing up the rear of this high-production paving spread was a Lewis finisher-float with double transverse screeds. It trailed a V-shaped bull float. Following the equipment train was a finishing crew with long handled floats. A burlap drag was used to give the pavement a rough surface. Permite curing compound was applied with a Rex machine, and finally a second coat was applied by a two-man crew with hand sprayers.

In addition to its work at the airport site, Langenfelder was recently awarded a $3.9 million contract for access roads.

In charge of the Chantilly project for Langenfelder is Project Manager Bill Hazlehurst. His general superintendent is B. G. Woolfolk. R. C. Mathern is paving superintendent, and Orville Carver runs the big concrete plant. Project engineer is Bill Gable.

Supervising construction for the Federal Aviation Agency is the consulting engineer firm of Amman & Whitney, New York, N. Y., represented on the job by Resident Engineer S. R. Ransome.



Mobile lounge 60 feet long and 15 feet wide will shuttle passengers from terminal to aircraft. Its capacity will be 80 passengers.

News from the Field

Highway Construction Costs Dip

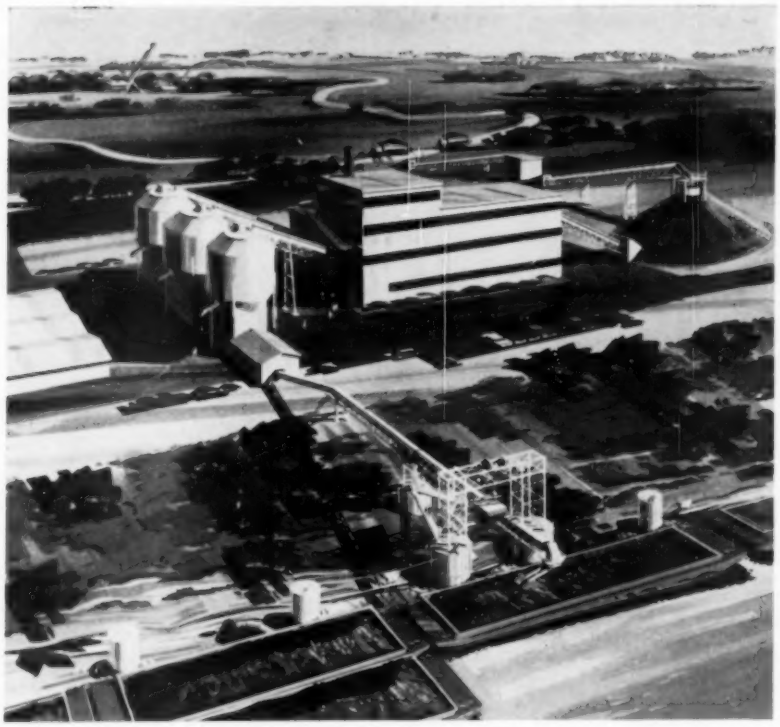
The cost of highway construction in the first quarter of 1960 dropped 2.7% below the previous quarter, Federal Highway Administrator Bertram D. Tallamy has announced.

Trends in highway construction costs are measured by an index of average bid prices compiled by the Bureau of Public Roads, U. S. Department of Commerce, from reports of federal-aid highway construction contracts awarded by state highway departments.

The decline in the bid price index in the first quarter of 1960 follows a 0.6% increase in the previous quarter. The small fluctuations of the past several years, together with the latest change, appear to indicate continuance of a trend of stabilization in prices. The currently reported decrease places the index 4.6% below the level of a year ago.

The price levels of the component items of the index in the first quarter of 1960, the previous quarter and the same quarter a year ago, and the corresponding percentage changes, are shown in the accompanying table.

Item	Price index (1946=100)			Percentage of change 1st quarter 1960 from—	
	1st quarter 1960	4th quarter 1959	1st quarter 1959	4th quarter 1959	1st quarter 1959
Excavation	104.6	110.3	114.4	−5.2	−8.6
Surfacing	146.8	149.8	151.7	−2.0	−3.2
Structures:					
Reinforcing steel	166.6	174.9	171.2	−4.7	−2.7
Structural steel	160.4	162.5	165.2	−1.3	−2.9
Structural concrete	136.0	136.1	141.6	−0.1	−4.0
Composite, structures	147.3	149.9	152.5	−1.7	−3.4
Composite price index	134.4	138.2	140.8	−2.7	−4.6



United Electric's Banner Mine coal preparation plant and barge-loading dock is on the Illinois River southeast of Peoria. Production capacity is 4,000 tons per day.

United Electric Opens Mine

Completion of its new Banner Mine, equipped with facilities for direct barge-loading of coal, has been announced by John M. Morris, president of United Electric Coal Companies, Chicago.

The mine is located on the Illinois River a few miles southwest of Peoria, and is producing a premium grade coal from the newly developed No. 2 Seam in Peoria County.

Banner is the first coal mine, built on the bank of a navigable river, with a conveyor only 600 feet in length to carry coal directly from preparation plant to river barge. The mine is all new from stripping shovel to loading dock, and incorporates the industry's most advanced techniques for efficient, large volume mining and preparation of coal.

Run-of-mine coal from the pit is delivered to the truck dump, moved by conveyor to a crusher and then on to a 2,500-ton storage pile.

Coarse coal is washed in a Dutch State Mines shallow still bath heavy media vessel. It can be crushed and rescreened to special domestic, commercial and industrial stoker sizes. Fine coal is cleaned by the Super-Airflow process.

Washed and sized coal, dustproofed if desired, is conveyed from the preparation plant to three storage bins, two of 1,500-ton capacity; one of 1,000-ton capacity. The coal is carried by conveyor through a carefully calibrated automatic weighing device, directly to the dock for loading of barges.

A new 45-yd. Bucyrus-Erie shovel is used in the pit for stripping operations. Production capacity of Banner Mine is 4,000 tons per day.

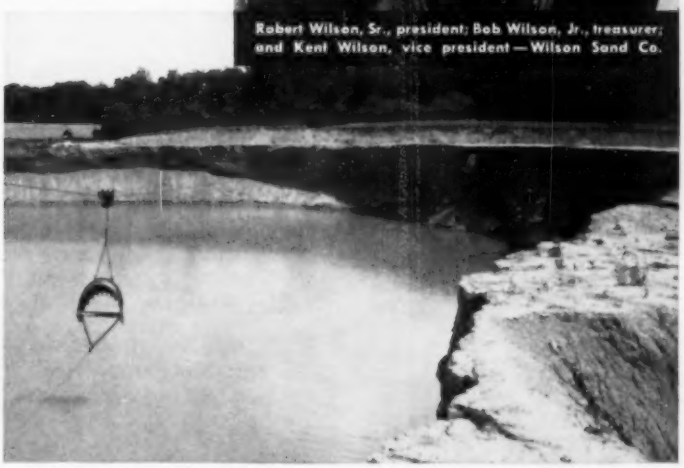
Coals from Banner Mine and from

Continued on page 72

Sauerman DragScraper Digs and Hauls from Pit to Hopper for 8¢ Per Yard

Robert Wilson, Sr., president; Bob Wilson, Jr., treasurer; and Kent Wilson, vice president—Wilson Sand Co.

Track Cable DragScraper inhauling load to hopper from 40 ft. below water.



DragScraper and carrier returning to pit by gravity. Average haul is 500 ft. on a 675-ft. span.

Operating costs for Wilson Sand Co.'s new Sauerman DragScraper are estimated to be less than 8 cents per yd. This includes labor, maintenance and power costs to dig from 40 ft. below water level and deliver 90 yds. per hr. to the field hopper on an average haul of 500 ft.

Wilson Sand Co.'s new 125-tph. plant represents a steady increase in capacity which started with 20 tph. in 1939, using a small Sauerman Slackline.

Sauerman equipment has kept pace with the growth of their Upper Sandusky, Ohio plant. The Slackline was replaced by a 1½-yd. track cable DragScraper in 1951, and with a 2-yd. machine in 1953. The new Sauerman unit is a 3-yd. track cable DragScraper operated by a two-drum electric hoist equipped with air controls.

The DragScraper is digging 35 to 45 ft. under water down to bed rock on a 675-ft. span. The pit bank stands 40 ft. above the water, thus total depth of the deposit recovered by the DragScraper is about 85 ft.

Excellent material and the right equipment to dig and process are responsible for the continued growth of the Wilson Sand Co. Officers of the company are Robert W. Wilson, Sr., President, Kent Wilson, Vice President and Bob Wilson, Jr., Treasurer.

You can cut *your* costs by digging and hauling with a Sauerman Machine sized to match your plant capacity. Track cable Drag-Scrapers dig from high banks, dry pits and deep water. They are built in sizes up to 15 yds. and operate economically on 1000-ft. spans. Start reducing your operating costs—write or call and tell us your job requirements.

After discharging load into field hopper, DragScraper is lifted from pile for return to pit. Conveyor at left leads to plant.

This Sauerman two-drum hoist controls operation of DragScraper.

SAUERMAN BROS., INC. 622 SO. 28th AVE. BELLWOOD, ILL.
Linden 4-4892 • Cable CABEX—Bellwood, Illinois
Crescent DragScrapers • Slackline and Tautline Cableways • Durolite Blocks

CUTTING CAPACITIES UP TO 1 INCH, 1 1/16 INCH, AND 1 1/2 INCH

THE
Morse-Starrett
WIRE ROPE CUTTER

FAST
Especially designed cutting blade and dies of the finest steel assure fast cutting action.

EASY
Anyone can operate it. The hammer principle eliminates any special skill requirements.

SAFE
The enclosed cutting blade locked in the body of the cutter assures perfect safety.

PORTABLE
Models for tool kit or stationary operation. Made in three sizes.

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MORSE-STARRETT PRODUCTS CO.
1204-49th AVENUE • OAKLAND 1, CALIF.

News . . .

Continued from page 70

the company's Cuba, Buckheart, Fidelity and Ruby mines are shipped in barge tows to destinations on the Illinois and Mississippi rivers, and to Chicago for transshipment to lake vessels for delivery to utility and industrial users at Great Lakes ports.

Moles Elect President

Chester W. Cambell, president and chief executive officer of The Foundation Co., New York City, was elected president of The Moles, an association of eastern heavy-construction engineers and executives. He succeeds Mansell L. MacLean, president of MacLean-Grove & Co., Inc.

C. W. Cambell

Other officers elected were Harry T. Immerman, Spencer, White & Prentis, first vice president; Eugene G. Rau, J. Rich Steers, Inc., second vice president; Joseph B. Diamond, treasurer; Eugene F. Moran, Jr., Moran Towing Corp., secretary; and H. Austin Van Name, H. A. Van Name Engineering Co., sergeant-at-arms.

Four men were elected to three-year trusteeships. They are William J. Green, S. J. Groves & Sons Co.; Edward J. Johnson, Moran Towing; Henry A. Letoile, Perini Corp.; and Gilbert M. Serber, Stock Construction Corp. Elected for a one-year term replacing Diamond as trustee was Edward G. Armitage, of Armitage & Co., Inc.

The new Moles president has been with Foundation Co. all but about 10 of his 35 years in heavy construction, and has been in his present position since 1956. He joined the company in 1926.

Film Features Water Resources

Water—the most wanted resource in the United States—is its most wasted resource.

Each year an average of 30 inches of precipitation falls on the total land area of the United States. And although it is not evenly distributed, this amount should be ample to meet all demands.

Yet news headlines daily tell a different story as more and more cities experience water shortages, and drought conditions prevail in areas where water has been abundant throughout the years. Floods, too, tell of a different aspect of the water problem.

This all-important subject—water and what must be done to assure a plentiful supply for the future—is the basis for a new Caterpillar picture released nationally. It is titled *Water Bill U.S.A.* Narrated by Walter Cronkite, the 27-minute long color film tells how citizens in various parts of the country have solved their water problems and what others can do.

The film points out that the very abundance of water is proof of how it is wasted. Between 90 and 95% of the water that falls on the nation escapes its city water systems, industrial plants and the irrigation pumps which supply farms. This leaves less than 10% which can be used to support the expanding economy.

An average American home, the movie reports, requires about 22,000 gallons of water per year for each member of the family. The end isn't in sight, for not only is the population growing—it is getting thirstier. By 1975, factories are expected to need almost as much water as the entire United States uses today for all purposes. And irrigation, which today requires 131 billion gallons per day, will need still more to keep up with growing demand for food.

To meet the demands expected by

Measures that will protect water resources are graphically shown through use of a watershed model by Walter Cronkite, as he narrates the color film *Water Bill U.S.A.*

1975 and beyond, Americans must make better use of water, storing it where it can be used to grow crops in dry years; allowing it to seep down into the underground reservoirs which have been depleted to the danger point in so many areas; and providing the necessary dams and reservoirs to keep pace with the needs of growing cities and industries.

Copies of *Water Bill U.S.A.* are available through Caterpillar Tractor Co., Peoria, Ill., and its dealers.

J. A. Chantrey Named Bucyrus-Erie Treasurer

Jack A. Chantrey was elected treasurer of Bucyrus-Erie Co., South Milwaukee (Wis.) excavator and drill manufacturer, at a meeting of the board of directors on April 26. He succeeds V. C. Studley, who continues as vice president in charge of finance. All other officers were re-elected, the company said.

J. A. Chantrey

Chantrey came to Bucyrus-Erie as assistant treasurer in 1959. Previously he had been a principal product planning analyst for the Ford Motor Co., Dearborn, Mich.; had served as senior traveling auditor, Standard-Vacuum Oil Co., New York; and as bank officer of the Tokyo (Japan) branch of the First National City Bank of New York.

Chantrey is a native of Lake Forest, Ill., and graduated from Oberlin (Ohio) College in 1947 with an A.B. in economics. He was a first lieutenant in the army Corps of Engineers during World War II, serving in the European theater.

Mississippi River Commission Gets New Head

President Eisenhower has nominated Maj. Gen. Thomas A. Lane to be president of the Mississippi River Commission at Vicksburg, Miss. He succeeds Maj. Gen. W. A. Carter, who will become governor of Panama Canal Zone about July 1.

Gen. Lane is now the commanding general at Fort Leonard Wood, Mo. He is a native of Massachusetts and graduated from West Point in 1928. His previous assignments include a tour of the Memphis District 1933-35. He was district engineer at Little Rock, Ark., about ten years ago. He also served a term as a member of the Board of Commissioners for the District of Columbia.

The 81-year-old Mississippi River Commission is an agency of the U. S. Army Corps of Engineers. It is composed of seven members appointed by the President and confirmed by the Senate.

The commission is charged with making the lower Mississippi valley safe from floods and improving the river as a navigation artery. The group was created in 1879 by act of Congress.

How to Ruin Drill Steel
Store your steels outdoors without protection against rain and snow.
Exert the greatest possible force on the pusher. In this way you will bend the drill steel and eventually manage to break the rod.
Handle steels roughly.
Use a drill with a worn-out rotation device. The heavy stress on both the rod and the bit will achieve early breakage.
Use the steel as long as you can without re-grinding.
Keep worn-out chucks and pistons in your rock drills. This is the recognized way to destroy the shank of the drill steel.
Do not follow the instructions for the grinding of drill steels.
Use steels for scaling. Experience everywhere shows that this is by far the quickest and most successful way to ruin a steel.

HOW TO DO IT, 1960 STYLE—Atlas Copco's cartoonist has taken a fresh look at rock drilling in the mining and construction fields, and reports that the methods shown and described above are the most effective to ruin tungsten-carbide-tipped drill steels.

Now!...Euclid Twin-Power

TS-14 all-wheel drive "Twin"

*heaped capacity at 3:1 is 16 yds., at 1:1 slope, 20 yds.

HERE'S BIG NEWS for scraper users. The many cost cutting advantages of all-wheel drive are now available in a medium-size scraper, the Euclid Model TS-14. With Twin-Power and a total of 296 h.p. this new "Euc" has already proved itself an outstanding performer. A one-man, one-machine earthmoving spread, it gets more work done at lower cost than any other scraper of comparable size . . . its high productive capacity brings a better return on investment.

Like the widely used 24 yd. "Twin", this new Euclid has a separate Torqmatic Drive and power train for each axle. It self-loads in practically any scraper material and with a pusher is a big producer on even the toughest jobs. There's plenty of power and traction to pick up a heaped load in a hurry . . . pull out of the cut fast . . . and highball on the haul and return.

The TS-14 works on grades and under adverse job conditions that stall other scrapers. Its ability to do a wide range of work — without pusher assistance — makes it the most versatile scraper in its class. This new "Twin" can lengthen your work season and give you a bidding advantage on that next job. Get the facts and figures from your Euclid dealer.

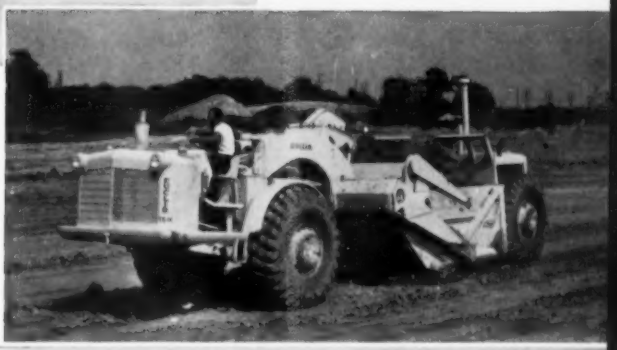
EUCLID Division of General Motors • Cleveland 17, Ohio

Check the advantages of all-wheel drive in this new 14 yd. Twin-Power scraper!

in this 14 yd.* scraper!

TS-14 features that cut dirt moving costs

- 2 engines — 296 total h.p.
- all-wheel drive
- NoSpin differentials
- 2 Torqmatic Drives
- converter lock-up
- 20 yds. heaped (14 yds. struck)



All-wheel drive and 296 total horsepower enable the TS-14 to get heaped loads without pusher assistance . . . make it a one-man earthmoving spread with more versatility than any other scraper in its class. Low wide bowl and four-section cutting edge speed loading and cut cycle time . . . blade sections are identical, adjustable and reversible.

The TS-14 works independently of other equipment . . . in the cut and on the fill . . . has the power and traction to self-load fast and work under adverse grade and job conditions that stop single engine scrapers. Its versatility and work-ability make this new "Euc" a top performer for low cost dirt moving on any scraper job . . . big yardage projects as well as close quarter work where concentration of equipment isn't practical.

Separate Torqmatic Drives for each axle provide a smooth, steady flow of power. There's no clutching, no delay, and no loss of momentum when changing to any of the 4 forward speeds . . . speed changes are made by a simple flick of the wrist at the air assist remote control lever. Converter lock-up assures maximum efficiency on grades and long hauls . . . this direct drive provides more usable power from each engine.

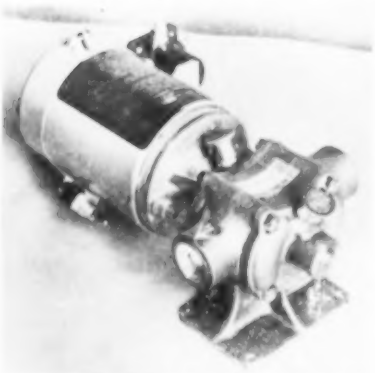
GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

Equipment You Ought to Know About

Transfer Pump



Manufacturer: Jerome Simer Co., Department EE, 422 Stinson Blvd., Minneapolis, Minn.

Claims: "Paddle Pump" is the trade name of an electric-powered transfer pump designed to handle on-the-job transfer of normal quantities of water and fuel. The pump is suitable for filling fuel tanks on diesel-powered excavators and other equipment. It eliminates the nuisance of using hand or engine-powered pumps.

The pump is a 20-gpm self-priming unit with 1-in. inlet and outlet. It is powered by a small DC motor which operates on 6 or 12-volt battery current. Normally, the pump and its motor unit are bolted to the outside of a pickup truck carrying the drums of fuel or other liquids.

The pump is made of brass with stainless steel shaft. It has internal rotary seals; SAE 64 bronze bearings; and synthetic "Rock Rubber" impeller.

Compact Crane-Excavator

Manufacturer: Bucyrus-Erie Co., Department EE, South Milwaukee, Wis.

Claims: A new crawler-mounted crane-excavator has been added to the compact-size models of the Bucyrus-Erie line. It is designated model 14-B.

As a crane, it is rated up to 9-ton capacity and is available with booms 25 to 80 feet long, and boom-jib combinations up to 85 feet. As a hoe or shovel, it can be equipped with ½ or ⅝-yd. dippers; as a dragline-clamshell, it handles buckets ranging up to ¾-yd. capacities.

Crawler mountings feature a choice of tread widths from 16 to 24 inches, reversible treads (with patented stabilizing lugs), and a single flame-hardened roller path for lateral flexibility.

For heavy-duty excavation or crane work, the crawlers can be augmented by a new optional stability feature—four screw-type jack outriggers which provide "square crawler" working advantages, and boost standard crawler capacities at least 15%.

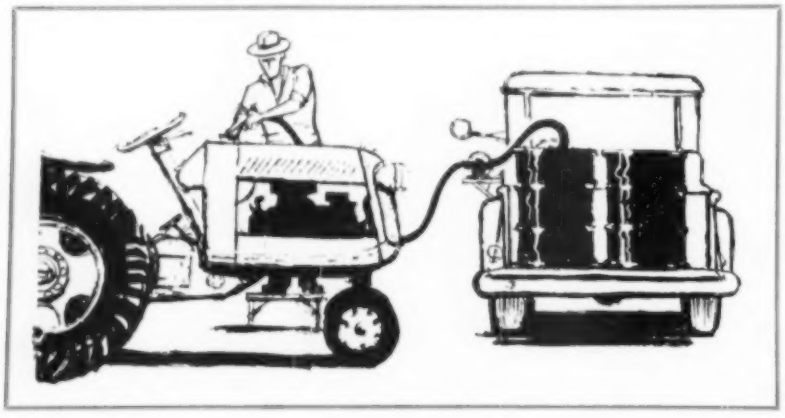
The upper works is mounted on a ball-bearing swing circle adjusted for life in the factory, pre-lubed and sealed.

Manual controls for the upper works are combined with air controls for steering clutches and brakes. Quick-shift spline-type clutches select the swing or propel motion.

Designed for easy maintenance, the machine has color-coded lubrication fittings; gears enclosed and running in oil, except swing gear and pinion which are lubricated by remote control grease gun; nylon pins and bushings in control lever system; reversible clutch bands; and simple clutch and brake adjustments.

The 14-B machinery has large-capacity, cool-running identical main clutches (with interchangeable parts); identical interchangeable main drum brakes; and swing brake plus independent air-controlled positive house lock. Boom hoist is an independent type.

Users can choose either a gasoline or diesel engine. Power combinations available are direct drive, three-speed transmission; or torque converter drive.

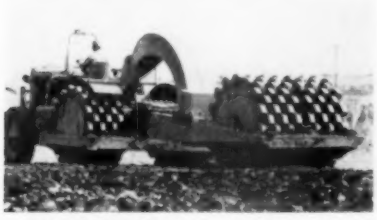


Grid Compacter

Manufacturer: Hyster Co., Department EE, P. O. Box 328, Peoria, Ill.

Claims: Hyster's new DW20A compacter is capable of reducing earth compaction costs to less than three cents per cubic yard, according to the manufacturer.

With compacting wheels designed for top effectiveness at high speeds, the unit offers high-production compaction in all classes of soil and rock fill material at speeds up to 15 mph. This high speed has made possible consistent production rates of 1,200 cubic yards per hour.



The DW20A is available with interchangeable new-design tamping wheels or Hyster's "grid" wheels.

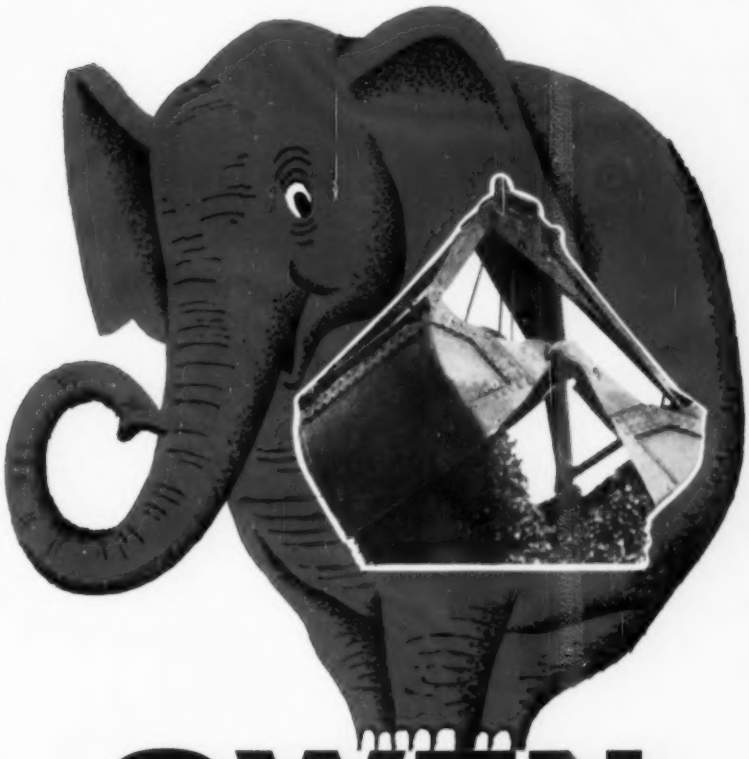
The compacter operates as an integral part of the Caterpillar DW20 tractor. Rear tractor wheels are replaced with compacting wheels, and a gooseneck trailing roller contains two similar wheels. Combined coverage width is 10 feet. Existing tractor axles, brakes and bearings are used for the tractor compaction wheels.

The new tamping compacter, best suited for plastic-type soils, utilizes Hyster tamping wheels designed to compact soil efficiently at top speed and achieve almost complete "walk-

Continued on page 78

BIG

in QUALITY and ECONOMY



OWEN

OWEN clamshells are constructed with increased power and more durability foremost in mind. One of these features is the recessing of the top of each lip to receive the bowl plates. This gives the bucket a smooth interior and also relieves all stress and shear on the rivets that join the lips to the bowl plates. **Recessed lips are standard on all OWEN buckets —and at no additional cost!**

This is just one of the many reasons why OWEN Buckets are guaranteed pound for pound—size for size—to get a bigger load each bite—a larger output each day.

Write us your exact requirements. Remember, OWEN Engineers are at your service. Send for Free Catalog today.

The OWEN BUCKET Co.
BREAKWATER AVENUE, CLEVELAND 2, OHIO
BRANCHES: New York • Philadelphia • Chicago
Berkeley, Calif. • Fort Lauderdale, Fla.

FOR 50 YEARS...
Finest in the Field!
Rely on the bucket contractors rely on. The Omaha Dragline Bucket gives full load with every cast. Perfect balance makes it easy to spot dump. Alloy steel cutting teeth stay sharp, tough and ready. Strike pay dirt now! Complete information and specifications await your letter.
DRAKE-WILLIAMS MOUNT
• OMAHA, NEBR.
OMAHA
DRAGLINE BUCKETS

New Equipment . . .

Continued from page 77

out." This design is the result of extensive research and study, and provides an optimum balance between ground contact area and soil pressure.

A new sloped-pad tamping foot enables drive wheels to develop more tractive effort than with flat pads. Higher gradability can be obtained with the assistance of traction-aiding devices.

The grid compacter is basically the same unit equipped with open surface wheels of heat-treated, cast alloy steel construction. The grid compacter is at its best in gravelly soil and rock crushing.

A variety of ballast combinations may be applied to suit either compacter directly to the job. Recommended ballast are three 4,000-lb. steel weights carried on the frame of the towed unit. Steel ballast of 5,000 pounds is recommended for the tractor. Wet sand may be carried in the wheels for additional weight.

Ground reactions for the unit are in excess of 30,000 pounds per set of wheels.

Power Shift Traxcavator

Manufacturer: Caterpillar Tractor Co., Department EE, Peoria, Ill.

Claims: A new "live power" Traxcavator features a power shift transmission. The new machine is the 955 Series H, a 100 net horsepower machine.

This is the second major improvement to the Caterpillar line of Traxcavators. A new 977 Series H, also power shifted, was recently introduced by the company.

The 955H is powered by a compact, turbocharged four-cylinder diesel engine. Bucket size has been increased from 1½ to 1¾-yd. capacity.

The new power shift transmission permits single lever shifting through all phases of the work cycle. A total of four work speeds are available to the operator—there are two gear speeds in both the high and the low work ranges.

Superior digging action and a 23% increase in lifting capacity result from a new hydraulic system for the loader.

Other improvements include an increase in the number of track rollers from five to six; adoption of a heavy-duty undercarriage with welded track guiding guards and lifetime lubricated rollers as standard equipment; a 52-gallon fuel tank; and a more efficient and more comfortable operator's compartment.

Forward speeds are: low range, 0-2.08 mph and 0-3.86 mph; high range, 0-2.68 mph and 0-4.93 mph. Reverse speeds are: low range, 0-2.62 mph and 0-4.83 mph; high range, 0-3.35 mph and 0-6.16 mph.

Live hydraulic power for the loader mechanism is assured by the pump being driven directly off the torque converter impeller.

Traxcavator features retained on the 955H include automatic bucket positioner and kickout; 40° tilt-back and 47½° tilt at maximum lift; three grouser track shoes; and hydraulic track adjusters.

All-weather in-seat operation of the gasoline starting engine is assured by the new 12-volt electric starter. A 24-volt direct electric system for

Continued on page 80

NO. 12 MOVES FLEXIBLE BASE FAST —UP TO 3800 CU. YD./10 HR. DAY

The No. 12 pictured above is one of 4 Cat Motor Graders working on an Interstate Highway improvement contract being handled by T. L. James & Co., Inc. and R. W. McKinney of Corsicana, Texas. The 7-mile paving job is near Richmond, Texas, and calls for 62,178 cu. yd. of concrete plus 98,740 cu. yd. of gravel and 95,420 cu. yd. of flexible base.

To keep production high and on schedule, these contractors rely on the No. 12's superior performance and operating efficiency to move flexible base fast. Equipped with a 14-ft. blade, this unit spreads 3600 to 3800 cu. yd. per 10 hr. day.

This is the kind of production and dependability you can expect from the 115 HP Cat No. 12 . . . now, more than ever, with the many improvements incorporated in the *new* Series E model.

The most notable improvement is the new compact engine which provides greater lugging ability in tough going, long life and easier servicing. Horsepower remains the same (115) but this new engine develops higher torque and gives the No. 12 greater load-handling capacity. Besides a new compact engine, the No. 12 Motor Grader now has the dry-type air cleaner as standard. Removing 99.8% of all dirt from intake air this cleaner can be serviced in 5 minutes . . . cuts maintenance time by as much as 70% and substantially reduces cost . . . extends engine life.

Still retained are the many important features that have made the No. 12 the leader in its class. There's the oil clutch, providing up to 2000 hours without adjustment . . . the equivalent to 12 months of operation. Ample clearance between the top of the moldboard and the bottom of the circle drawbar provides greater rolling action . . . allows more material to move across the blade. Improved mechanical controls make engagement easier. Blade controls have a mechanical lock to insure positive blade position. When control is in neutral, the power shaft is locked by a set of gear teeth to prevent creeping.

These are just a few of the reasons why the NEW Cat No. 12E Motor Grader is out front. To get the complete picture, see your Caterpillar Dealer. He'll show you proof of top performance with an on-the-job demonstration!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

STEP UP PRODUCTION WITH THE IMPROVED NO. 12

New Equipment . . .

Continued from page 78

the diesel engine is available as optional equipment.

Dumping height is 130 inches, with a dumping reach of 41.2 inches at a 45° discharge angle.

A full line of attachments, including side-dump bucket, is available. Other attachments are: light material bucket (2⅜-yd. capacity); skeleton rock bucket; heavy material bucket; quarry bucket; bulldozer blade; bucket teeth; counterweight, ripper; and fork attachments. Hydraulic control arrangements for front and rear-mounted attachments are also available.

"V-Power" B Tournapull

Manufacturer: LeTourneau-Westinghouse Co., Department EE, 230 N.E. Adams St., Peoria, Ill.

Claims: With a new 430-hp V-12 diesel engine as standard equipment, the LeTourneau-Westinghouse model B Tournapull is now a 29-yd. companion to the high-performance "V-Power" model C.

Even when pulling L-W tandem Fulpak scrapers with a load totaling 40 cubic yards, the horsepower to weight ratio of the V-Power B is slightly better than the previous standard model B prime mover and 28-yd. scraper combination.

A 28% increase in horsepower accounts for the improvement in performance. Acceleration time is cut by nearly a third as the machine comes out of the cut and gets up to haul speed. One operator during the field test program commented, "It's like climbing out of a sedan and into a sports car."

The extra power is felt too, in faster loading and superior gradability. The operator finds that far fewer downshifts are necessary even in steep going under full load.

A new speed feature of the V-Power B is a high-inertia steering motor. It automatically provides two rates of steer—slow for controlled "no-whip" steering at high-travel speed on the haul road, and quick sharp steer when it is needed for maneuvering in tight places or making tight turn-arounds in the pit or on the fill. With the new system the operator can swing the nose of the prime mover 180° from full left to right at about twice the speed as on the previous model.

Capacity of the B Fullpak scraper

NEW... SUPER HOE ADJUSTABLE BOOM

Money-Making Efficiency and Versatility

The new, patented Super Hoe boom and slider now permits the operator to readily change the effective length of the boom for greater range and greater depth.

On a ¾ yard machine, for example, the effective length of the boom can be varied from 10 feet out to 23 feet. This results in scores of advantages, including:

- ¾ yard machine will dig 10' level floor at 20' depth.
- Trenching in restricted areas and around service lines is facilitated. Dirt can be moved farther from excavation.
- The average residential basement can be dug with only four corner sets.
- Line and grade can be better maintained. Footings can be accurately dug with the same machine.

RUSH COUPON for complete information

BURG MFG. CO.
Dept. EE, Waverly, Nebraska

☐ Send name of nearest distributor
☐ Send descriptive literature
☐ Tell me where I can see your 10-minute movie

Name_____
Company_____
Address_____
City_____ State_____

has been increased. Struck rating is up nearly 10% from 21 to 23 cubic yards. Heaped, it now carries 29 yards. The modification to permit the increase involved only minor changes which in no way effect ease and speed of loading.

The engine, a model 12V-71 built by General Motors, is a 2-stroke design of 851-cu. in. displacement. It develops its 430 horsepower at 2,100 rpm, and reaches a torque peak of 1,210 foot-pounds at 1,200.

The V-Power B prime mover is also available with various combinations of scrapers through use of L-W's recently announced tandem system. Some combinations include: Tandem B Fullpaks totaling 58 cubic yards capacity; Tandem C Fullpaks for a 40-yd. total; or a B-C combination, using a B Fullpak as the first unit and C Fullpak as the second, total capacity 49 yards. An interchangeable 35-ton rear dump trailing attachment is also available.

Gas Engine

Manufacturer: Allis-Chalmers Mfg. Co., Department EE, Milwaukee 1, Wis.

Claims: A new addition to the A-C line of gasoline and natural gas engines is the model G-138. It is a new 4-cycle, 4-cylinder, 138-cu. in. piston displacement unit that develops 39-hp at 1,800 rpm.

The new engine is a companion to the Allis-Chalmers G-149 and G-226 engines, and is being built at the company's West Allis (Wis.) works. The G-138 power unit is 46 inches long, $18\frac{15}{16}$ inches wide, and $30\frac{1}{2}$ inches high to top of the radiator, making it a compact unit. The engine weighs 402 pounds, and the entire power unit 622 pounds.

Its applications will be in construc-

Continued on page 85

BUILT TO DIG!
Constant digging power throughout the digging cycle.
Wide head, upright bars for greatest digging power.
Correctly shaped scoops have no interior angles or projections; assure smooth, fast dumping.
Full complement of five sheaves for fullest digging power, readily adjustable to any lesser parts of line.
Weight concentrated at lower block for quickest opening and greatest digging power
Brackets over-hang to assure maximum power.
Independent (double) hinge suspension, scoops can dig individually.
Contact type bumpers eliminate friction in starting digging cycle.
WILLIAMS BUCKETS
Durable clamshell and dragline buckets for every application
Williams Bucket Division, The Wellman Engineering Company, 113 St. Clair Ave. N.E., Cleveland 14, Ohio
SEND FOR FREE CATALOG
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The Wellman Engineering Co.
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C-2
Please send me the new Williams Bucket catalog.
NAME
COMPANY
ADDRESS

New Equipment . . .

Continued from page 78

the diesel engine is available as optional equipment.

Dumping height is 130 inches, with a dumping reach of 41.2 inches at a 45° discharge angle.

A full line of attachments, including side-dump bucket, is available. Other attachments are: light material bucket (2⅜-yd. capacity); skeleton rock bucket; heavy material bucket; quarry bucket; bulldozer blade; bucket teeth; counterweight; ripper; and fork attachments. Hydraulic control arrangements for front and rear-mounted attachments are also available.

"V-Power" B Tournapull

Manufacturer: LeTourneau-Westinghouse Co., Department EE, 230 N.E. Adams St., Peoria, Ill.

Claims: With a new 430-hp V-12 diesel engine as standard equipment, the LeTourneau-Westinghouse model B Tournapull is now a 29-yd. companion to the high-performance "V-Power" model C.

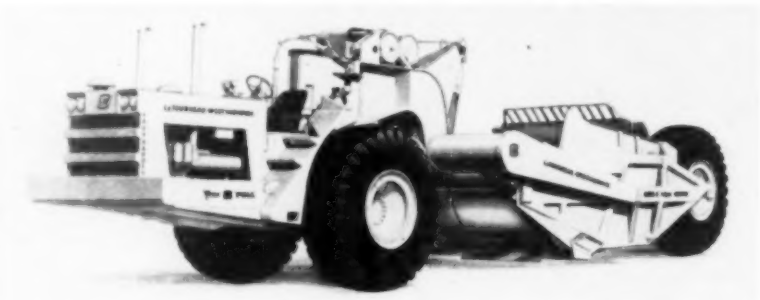
Even when pulling L-W tandem Fulpak scrapers with a load totaling 40 cubic yards, the horsepower to weight ratio of the V-Power B is slightly better than the previous standard model B prime mover and 28-yd. scraper combination.

A 28% increase in horsepower accounts for the improvement in performance. Acceleration time is cut by nearly a third as the machine comes out of the cut and gets up to haul speed. One operator during the field test program commented, "It's like climbing out of a sedan and into a sports car."

The extra power is felt too, in faster loading and superior gradability. The operator finds that far fewer downshifts are necessary even in steep going under full load.

A new speed feature of the V-Power B is a high-inertia steering motor. It automatically provides two rates of steer—slow for controlled "no-whip" steering at high-travel speed on the haul road, and quick sharp steer when it is needed for maneuvering in tight places or making tight turn-arounds in the pit or on the fill. With the new system the operator can swing the nose of the prime mover 180° from full left to right at about twice the speed as on the previous model.

Capacity of the B Fullpak scraper



NEW... SUPER HOE ADJUSTABLE BOOM

Money-Making Efficiency and Versatility

The new, patented Super Hoe boom and slider now permits the operator to readily change the effective length of the boom for greater range and greater depth.

On a ¾ yard machine, for example, the effective length of the boom can be varied from 10 feet out to 23 feet. This results in scores of advantages, including:

- ¾ yard machine will dig 10' level floor at 20' depth.
- Trenching in restricted areas and around service lines is facilitated. Dirt can be moved farther from excavation.
- The average residential basement can be dug with only four corner sets.
- Line and grade can be better maintained. Footings can be accurately dug with the same machine.

RUSH COUPON for complete information

BURG MFG. CO.
Dept. EE, Waverly, Nebraska

☐ Send name of nearest distributor
☐ Send descriptive literature
☐ Tell me where I can see your 10-minute movie

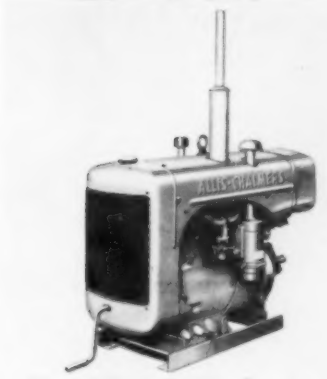
Name_____
Company_____
Address_____
City_____ State_____

has been increased. Struck rating is up nearly 10% from 21 to 23 cubic yards. Heaped, it now carries 29 yards. The modification to permit the increase involved only minor changes which in no way effect ease and speed of loading.

The engine, a model 12V-71 built by General Motors, is a 2-stroke design of 851-cu. in. displacement. It develops its 430 horsepower at 2,100 rpm, and reaches a torque peak of 1,210 foot-pounds at 1,200.

The V-Power B prime mover is also available with various combinations of scrapers through use of L-W's recently announced tandem system. Some combinations include: Tandem B Fullpaks totaling 58 cubic yards capacity; Tandem C Fullpaks for a 40-yd. total; or a B-C combination, using a B Fullpak as the first unit and C Fullpak as the second, total capacity 49 yards. An interchangeable 35-ton rear dump trailing attachment is also available.

Gas Engine



Manufacturer: Allis-Chalmers Mfg. Co., Department EE, Milwaukee 1, Wis.

Claims: A new addition to the A-C line of gasoline and natural gas engines is the model G-138. It is a new 4-cycle, 4-cylinder, 138-cu. in. piston displacement unit that develops 39-hp at 1,800 rpm.

The new engine is a companion to the Allis-Chalmers G-149 and G-226 engines, and is being built at the company's West Allis (Wis.) works. The G-138 power unit is 46 inches long, $18\frac{15}{16}$ inches wide, and $30\frac{1}{2}$ inches high to top of the radiator, making it a compact unit. The engine weighs 402 pounds, and the entire power unit 622 pounds.

Its applications will be in construc-

Continued on page 85

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Wide head, upright bars for greatest digging power.
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113 St. Clair Ave. N.E., Cleveland 14, Ohio
C-2
Please send me the new Williams Bucket catalog.
NAME
COMPANY
ADDRESS

With the planet-powered 230-hp TD-25 pushing—and with 375 high-torque International Diesel hp under the "295's" hood—you heap on 34-cu. yd. with amazing new speed. Even in toughest loading conditions, "X"-member reinforcing maintains perfect Payscraper push-frame alignment!

Note that the Payscraper apron lifts to a big 94-inch opening. Two ejector-plate pushing members apply dozer-like action to force out the whole 34-cu. yd. load cleanly. The 122-inch bowl width speeds unloading, and loading, too—adds control ease and stability, loaded or empty.

How Payscraper® power and power controls boost your dirt-on-fill delivery!

You get highest power-to-payload punch of all rubber-tired rigs in the 34-cu. yd. International 295 Payscraper. The fast-slugging, high-torque 6-cylinder International DT-817 Diesel is the Payscraper power plant.

The direct-start, 375-hp DT-817 is turbocharged to give you all-altitude, high-efficiency performance—power for cycle-speeding rim-pull—plus time-saving "no-lag" control power!

You power-shift the Payscraper, up or down—and the 4-speed planetary-type, torque-converter transmission provides load-speeding *automatic* direct-drive lock-ups in second, third, and fourth gears!

You power-steer the 150,000-lb. loaded Payscraper almost as easily as a 3,600-lb. automobile. Payscraper gives you the big control advantages of (1), exclusive International rack-and-pinion plus tandem pump steering system; and (2), 3-degree forward spindle pitch that improves scraper balance and prevents "nose-downs" in high-speed turns!

You power-control Payscraper dirt-handling actions with fingertip ease with the International PTO-driven Cable Control Unit. One cable drum of this simple planetary system actuates the apron and ejector; the other drum positions the bowl to control loading and spreading! Reach-easy Payscraper power brakes give you fast, positive stopping!

Ease into the bump-smothering Payscraper seat—press the direct-start button—power-shift the outfit into action. Compare the speed of loading, roading, and dumping the 122-inch bowl. See how the advantages of DT-817 Diesel power and complete, positive Payscraper power control can boost your dirt-on-fill delivery. Choose the 2-axle "295," or 3-axle, 34-cu. yd. "495." See your International Construction Equipment Distributor for a demonstration!

Here's your 76-page cost and production estimating book—newest, most authentic and complete guide for estimating material-moving costs—and for selecting equipment combinations for top profits, *anywhere!* Yours for the asking from your International Construction Equipment Distributor!

International® *Construction Equipment*

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE

Positive power-control of all operations adds safety, builds operator confidence — makes him "haul-speed minded" to help you get full capacity and profit from Payscraper speeds up to 33.5 mph. For example, safe, effortless tandem-pump power-steering leaves "the steering feel in the steering wheel"—gives positive, one-hand control!

The most wanted drill in the industry

THE 50-R

Drills blast holes up to 12¼-in. diameter . . . puts down almost 33 feet of pipe without stopping . . . makes short work of granite and quartz formations . . . *gives you more footage per dollar than any drill in its class.*

What's more, it's ready when you need it, day after day . . . even under most demanding conditions, owners find they can count on the 50-R to deliver high-production drilling without frequent time outs for repairs.

See your Bucyrus-Erie distributor for complete information on the 50-R and other Bucyrus-Erie rotary blast hole drills. Write Bucyrus-Erie Company, Drill Division, South Milwaukee, Wisconsin.

BUCYRUS ERIE®

. . . most respected name in the field

Continued from page 81

tion, mining and quarrying; irrigation and other pumping projects; plus other fields where portable power units are used. The G-138 is expected to become a standard with original equipment manufacturers using engines of this size.

The G-138 is sold and serviced by Allis-Chalmers engine, construction machinery and farm equipment dealers.

2¼-Yd. Loader

Manufacturer: Eimco Corp., Department EE, P. O. Box 300, Salt Lake City, Utah.

Claims: Latest addition to the 100-hp Eimco 103 series of crawler-tractors is the model 123 front-end loader.

This 74-in. gauge machine has a bucket capacity of 20,000 pounds at carry position, and maximum break-out force with the bucket heeled on the ground of 25,000 lbs. The sand and gravel bucket capacity has an SAE rating of 2¼ cubic yards; the rock bucket has a 2-yd. capacity and 2¼-yd. heaped capacity. Working weight is 29,200 pounds.

The Eimco 123 features loader arms, main frame, final drive and center housing made of steel cast by Eimco's unitized "stress flow" construction, with no bolts or welds. The process puts extra strength and weight where needed. The smooth flow of steel in the bucket arms is shown in the photo of this unit. A unique "single-stick" controls all actions of the arms and bucket.

As in all Eimco 103 tractors, power is transmitted through "Unidrive" transmission and "Quadra-Torque," giving four speeds both in forward and reverse; flip-of-the-lever gear and direction changes; and a speed range of from 0 to 6.5 mph. A single-stage torque converter is standard on all units.

Marion rock bodies are BUILT TO TAKE IT!

Fleet of Marions On The Job Regularly Since 1954 Provide Top Payload Performance With Minimum Downtime At Indiana Quarry

Seven Marions—two in service since 1948 and five since 1954—have been giving their owners top payload performance with minimum downtime.

Each unit hauls about 280 tons per day in 35 trips from the quarry to the crusher. The bodies are RB-50s, 5 cubic yards, with sideboards. The double arm underbody hoists are HD-8s.

Other Marion equipment in use at this ultra-modern quarry includes 5 trailer dumps, 5 tandem axle and 5 single axle units. The owners also use Marion equipment exclusively at their other two operations—a quarry and a coal mine.

If you want more information about how rugged Marion rock bodies and heavy duty hoists can help your quarry operation, write direct or see your Marion Distributor.

MARION METAL PRODUCTS CO.
Marion, Ohio, U.S.A.

NOT in the Contract

The wife of a retired admiral was asked by a reporter what effect a Navy career had on marriage.

"During the 30 years we spent in the Navy," she replied, "my husband was home only half the time. Either way you look at it, you're guaranteed a happy marriage at least 50% of the time."

Two men met in a blood donor station. One was an eastern tourist and the other was an Apache Indian. After staring a few moments, the tourist could no longer contain his curiosity.

"Are you really a full-blooded Indian?" he asked.

"Well, no," answered the other thoughtfully. "I'm one pint short."

Bystander: "Henry, when you was in the big city did you go into any of them places that had a sign up over the door that said *GIRLS, GIRLS, GIRLS*?"

Henry: "No, but I got throwed out of a place that had a sign over the door saying *WOMEN*."

It was springtime in England, and the Brooklynite visiting a London park was overwhelmed by the number of sparrows milling about the lawns. He tapped lightly the shoulder of the Englishman standing next to him.

"Hey, Mac, didya ever see so many boids?"

"My good man," said the Englishman with a reproachful look. Those are no 'Boids.' They're BIRDS."

The Brooklynite scratched his head thoughtfully. "Dat's funny," he mumbled, "dey choips just like boids."

Doctor: "Your husband must have rest and quiet. Here's a sleeping powder."

Wife: "When do I give it to him?"

Doctor: "You don't give it to him, you take it yourself."

Chaplain (to prisoner in electric chair): "Can I do anything for you?"

Prisoner: "Yes, hold my hand."

"Yes, Sam's a retired shovel operator. How did you guess?"

The lush's wife trailed him to his favorite tavern. Standing at the bar next to him, she ordered a slug of whiskey. Tasting it, she made a wry face. Contempt covered her every feature.

"How can you drink that awful stuff?"

"See, honey," he said exultingly, "and all these years you thought I was having a good time."

Young son: "Dad, mom just backed the car out of the garage and ran over my bicycle."

Dad: "Serves you right for leaving it on the front lawn."

A man who took great pride in his lawn moved into a new home where there was a heavy crop of dandelions.

After trying every known device to get rid of them, he wrote the Department of Agriculture enumerating all of the things he had tried, and ending, "What should I do now?"

The reply from Washington said, "We suggest that you learn to love them."

Psychiatrist: "What did you say?"

Contractor: "I said for some reason or other, people don't like me—pay attention, fathead!"

Enraged because her husband had left his money to someone else, the widow went at once to the monument maker to have the inscription on his tombstone changed.

"Sorry," said the man, "but you ordered 'Rest in Peace' and it can't be changed now."

"Well, then," replied the widow, "Just add underneath 'Till We Meet Again.'"

Pity the unfortunate shoe salesman with a lisp who was slapped when he asked a plump female to sit down while he "looked up her thize."

Mr. Brown was out for a drive on a Sunday afternoon with his wife. He pulled to a stop at a very busy corner but he was unable to see to his right. He asked his wife if any cars were coming.

"No," she replied after a careful look. Then, just as he pulled into the highway, she added, "—just a gravel truck."

Comparison study of Cat DW21G Tractor with SynchroTouch Transmission Control shows

DW21 SERIES G HAULING COSTS ...32% lower than Tractor X ...16% lower than DW21 Series C

Results on the job are the only true measure of a machine's ability to produce *profitably*. Competing on an actual job under identical conditions against Tractor X and a DW21 Series C, the new Caterpillar DW21 Series G-470B team hauled dirt at lowest cost per cu. yd. The combination of SynchroTouch Transmission Control on the tractor and LOWBOWL design of the scraper is unbeatable—note the results below. Your Caterpillar Dealer has a complete report on this job as well as other revealing time-and-cost studies. Ask him to show them to you. See for yourself how the DW21G-470B can step up your profits!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

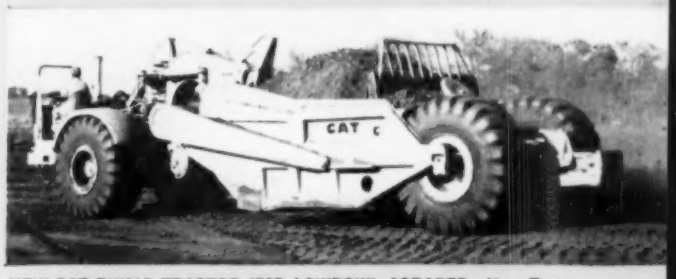
• • • •

PROJECT: South End Shopping Center, Tukwila, Wash. **PURPOSE OF STUDY:** To compare production and cost per yard of equipment observed. **EQUIPMENT:** One DW21G with SynchroTouch Transmission Control; two Tractor X (24-yd. struck, plus 36-inch sideboards); and three DW21C (18 yd. struck). **JOB CONDITIONS: Material**—slightly damp clay with some sand. **Density**—3425 lb./bank cu. yd., average of three tests, oil method. **Haul length**—1300 ft. (one way), return same route. **Haul road conditions**—soft, not maintained during study. **Weight test**—loads weighed with Streeter-Amet Electronic Scales. **Pusher**—all units pushloaded by D9 with Torque Converter Drive.

JOB DATA:	Cat DW21G w/SynchroTouch	Cat DW21C	Tractor X
Average Load Time	.73	.75	1.20
Average Haul, Dump and Return Time	4.14	4.67	4.25
Average Wait Time	.44	.44	.44
Average Cycle Time	5.31	5.86	5.89
Average Payload in Bank Yards	20.0	17.5	23.9
Trips per Hour	11.3	10.0	10.0
Average Hourly Prod. (bank cu. yd.)	226	175	239
Owning and Operating Costs per Hour*	$20.37	$18.87	$31.84
Cost per Yard	9¢	10.8¢	13.3¢

*Hauling costs only—does not include pusher costs

FIELD ENGINEERS WEIGHED LOAD AFTER LOAD as the competing units passed over the portable Streeter-Amet Electronic Scale. By subtracting average empty weight from average gross weight, they determined the average net load weight. This and other job studies prove that the new DW21G-470B hauls dirt at lowest cost per cu. yd., regardless of capacity of competing scrapers.



NEW CAT DW21G TRACTOR-470B LOWBOWL SCRAPER. New Turbocharged 345 HP Cat Engine delivers 12% higher rimpull giving up to 20% faster travel speeds under similar haul conditions than the previous model. With SynchroTouch Transmission Control (optional), operator simply dials desired gear for automatic, split-second, touch-and-go response. New 470B LOWBOWL Scraper is rated at 19.5 cu. yd. struck; 27 cu. yd. heaped. LOWBOWL design loads more material faster because of less loading resistance. Result: DW21G-470B moves dirt at lowest cost per cu. yd.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

HAUL AT LOW COST PER CU. YD. WITH A DW21G-470B

BEST TRACK... BIGGEST SAVINGS

Allis-Chalmers boosts work hours, cuts costs with the best tractor undercarriage in the business. You get industry's toughest track... best designed track guards ... certified, permanently lubricated truck wheels, idlers, support rollers.

Next time you watch track shoes squeal and grind against jagged rock . . . or see 'em buried sprocket-deep in mud, consider this: Nothing slugs it out with tough conditions like an Allis-Chalmers tractor undercarriage.

Specially heat-treated track shoes, side bars, track pins and bushings are the industry's toughest. Bushings extend into counterbored side bars to seal out dirt, provide more bearing area.

Track guiding truck wheel guards provide a deep-flanged guide channel that keeps track riding true on sprockets, idlers and truck wheels even in the roughest and toughest going. The solid A-frame holds the truck frames in absolute alignment — keeps track running straight.

PERMA-SAFE truck wheels, idlers and support rollers on all Allis-Chalmers tractors roll on tapered roller bearings, are protected against dirt and moisture by Positive Seals. Factory-lubricated, they're certified never to need further greasing.

We invite a maintenance cost comparison with any other tractor undercarriage. We further invite you to inspect the Allis-Chalmers healthy, long-lived tractor engine, the all-steel main frame, double-reduction final drives and many other cost-cutting features. Your Allis-Chalmers dealer will be happy to give you full details. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

move ahead with

ALLIS-CHALMERS

power for a growing world

21

LOW COST
DE-WATERING
with
FLYGT
ELECTRIC
PUMPS
On a recent $23,180,000 Sewer Job in California, 8 separate contractors licked severe ground water intrusion on a pipeline excavation 19 miles long with more than 40 Flygt Electric, Submersible Pumps. The Flygt pre-dewatering systems drained and kept dry ditches along the right-of-way at low cost in comparison with other dewatering methods. Typical of contractor comments on the system is this statement by the J. S. Barrett Co., who placed 5½ miles of 78" line:
"You just drop Flygt Pumps in the hole, turn them on and make only routine inspections. They keep the ditch dry at realistic cost with none of the trouble normally experienced with suction-type pumps."
Flygt Electric, Submersible Pumps range from 1½" 85 gpm to 8" 3100 gpm capacity. Heads to 220'—higher in tandem. Designed and built for tough applications, they are adaptable to any dewatering job. Flygts run continuously with little attention, handle a high degree of solids, need no priming, are easy to handle and service. Ask today for literature and an on-the-job demonstration.
WRITE FOR NAME OF YOUR NEAREST DEALER
FLYGT
PUMP BETTER ELECTRICALLY
— USE FLYGT!
WESTERN SALES & SERVICE
Stanco
MFGS. & SALES INC.
1666 Ninth St. (Corner of Olympic & Ninth)
Santa Monica, California

New Trade Literature

Subject: **30-Yd. Scraper**

Content: A 4-page full color fold-out brochure briefly describes the operating features of the recently introduced 30-yd. Allis-Chalmers TS-360 motor scraper. The literature points out the advantages of the scraper's all-hydraulic operation and its KON-TORK differential. Ask for folder MS-1376.

Where to get: Allis-Chalmers Mfg. Co., Construction Machinery Div., Department EE, Milwaukee 1, Wis.

Subject: **Transistorized Two-Way Radio**

Content: A bulletin on G-E's new transistorized line of two-way radio equipment describes how the product may be mounted in cars and trucks. Size of the unit is 8½x12x4 inches. Charts show how the vehicle's battery can be saved due to the low power requirements. The transistorized unit uses only 0.04 amperes on standby (with the engine off, ready to receive a call at full volume). This is less drain than the power required by a typical automobile clock, which runs continuously. Ask for bulletin ECR 666.

Where to get: General Electric Communication Products Div., Lynchburg, Va.

Subject: **Clam, Dragline Buckets**

Content: A 32-page illustrated catalog covers all types and sizes of Williams clamshell and dragline buckets and stone grabs. Detailed information describing the principles of bucket operation and selection as well as complete, easy-to-read specification charts are included.

Where to get: Williams Bucket Div., Wellman Engineering Co., Department EE, 113 St. Clair Ave., N.E., Cleveland 14, Ohio

Subject: **Rear-Dump Hauler**

Content: A 12-page brochure lists features of the Aveling-Barford model SL270 13½-ton Dumper. Photos and text point out that the vehicle's reversible driving seat and dual controls enable the operator always to face direction of travel. Powered by a 163-bhp Leyland engine, the unit has four speeds forward (from 4.5 to 25 mph) and four speeds in reverse (from 3.8 to 19.2 mph) for quick maneuvering in either direction. The unit's dump body, measuring 8½ by 11 feet, provides a big target for the loading shovel. The body reaches a full 70° tip in 10 seconds.

Where to get: Aveling-Barford Ltd., Department EE, Grantham, England.

Subject: **Electronic Surveying**

Content: An 8-page illustrated booklet discusses the principles of precise distance measurement with micro-waves. It explains the Tellurometer system for determining length of lines 500 feet to 40 miles in length. This system has practical applications for highway, pipeline and transmission line traverse; for trilateration and for offshore positioning of oil rigs, dredges and other construction machinery. Ask for bulletin 31-A.

Where to get: Tellurometer, Inc., Department EE, 206 Dupont Circle Bldg., Washington 6, D. C.

Subject: **Torque Converters**

Content: Clark's new 14, 15 and 16-in. torque converters for heavy-duty off-road vehicles are described in a four-page folder. Features of optional equipment, such as clutch controls and reduction drive, are detailed. Complete power curves for each of the three basic models are illustrated. Input of the three wheel-sizes in the new line vary from 400 to 775 pound-feet. Multiplication ratios range from 2.5-to-1 to 3.1-to-1. Ask for bulletin FFS-5.

Where to get: Clark Equipment Co., Automotive Div., Department EE, Jackson, Mich.

Subject: **Seismic Analysis**

Content: An 8-page booklet, *Ripping With Seismic Analysis*, tells how earthmoving costs can be reduced by the use of crawler-drawn rippers, instead of blasting, in some materials. The principles, method and operating technique of seismic analysis are discussed. A table showing the rippability of various materials such as limestone, sandstone, gneiss, caliche, conglomerate and other materials is included. In seismic analysis, the velocity of shock waves traveling through the subsurface is used to determine the degree of consolidation or rippability, and the depth of each layer

of below-the-surface materials. Ask for form 33793.

Where to get: Caterpillar dealers or Caterpillar Tractor Co., Department EE, Peoria, Ill.

Subject: **65-Ton Crane**

Content: A Manitowoc catalog features the new model 3400—a 65-ton capacity crane convertible to dragline, shovel, trench hoe and clamshell.

Overhead clearance heights are reduced as much as 9 inches because the model 3400 has a large-diameter, wide roller path and extra-strong king pin which eliminate the need for hook rollers. This feature allows the machine to travel and work in places previously inaccessible to a crane of this size and capacity.

Where to get: Manitowoc distributors, or Manitowoc Engineering Corp., Department EE, Manitowoc, Wis.

Subject: **Open Chain Lubricant**

Content: A four-page folder reports that a new Whitmore special lubricant makes open chains last up to three times longer. The lubricant is packaged in a 16-oz. push-button aerosol container. It is formulated especially for use on open chains. It combines the features of a penetrant, lubricant and a rust-preventative. The folder illustrates many types of conveyor, transmission, and elevating chains and indicates the critical points that benefit from specialized lubrication.

Where to get: Whitmore Mfg. Co., Department EE, Cleveland 4, Ohio.

Subject: **Gas Turbines**

Content: An 8-page bulletin introduces General Electric's family of 75-hp to 20,000-hp ultra-lightweight, compact gas turbines. They are designed for a wide variety of applications including fluid and gas pumping; electric power generation; and marine and vehicular propulsion. The bulletin describes design features, performance and operating characteristics, plus current and potential applications for the 900-hp model 720/722 and 20,000-hp model 240 gas turbines. Ask for bulletin GEA-7083.

Where to get: General Electric Co., Department EE, Schenectady 5, N. Y.

Here's where to get your best buys in used equipment!

BONDED BUY

**Spence Long,
Used Equipment Manager,
Hoover Equipment Company,
Caterpillar Dealer
in Oklahoma City.**

"This is a section of our used equipment lot—one of over 300 Caterpillar Dealers' lots in the U. S. Right here, as in any of the others, you can find the used machine you want for the purpose you want at a fair, realistic price. What's more, you don't buy 'blind.' We recondition, classify, label and *guarantee* our trade-ins. *We* know what you're buying... *you* know what you're buying.

"To help you get what you want, we classify most all of our used equipment into three types of *protected* buys, one of which should be right for your needs. Here they are:

1. A 'BONDED BUY' Cat-built machine, with a warranted value up to $10,000—it guarantees satisfactory equipment performance and supplies free of charge *all* parts and labor on the machine during the guarantee period.
2. A 'CERTIFIED BUY'—a written guarantee covering units of any make in very good condition.
3. A 'BUY AND TRY' deal—a written money-back agreement on certain machines not in the above two classifications.

"Regardless of the type or kind of equipment you buy, we want it to earn money and pay off for you with satisfactory performance. We back every machine with prompt service and parts you can trust. Believe me, all Caterpillar Dealers do. Every Caterpillar Dealer offers the best buys in used equipment. You'll find him listed in the Yellow Pages!"

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

BEST USED EQUIPMENT BUYS ANYWHERE

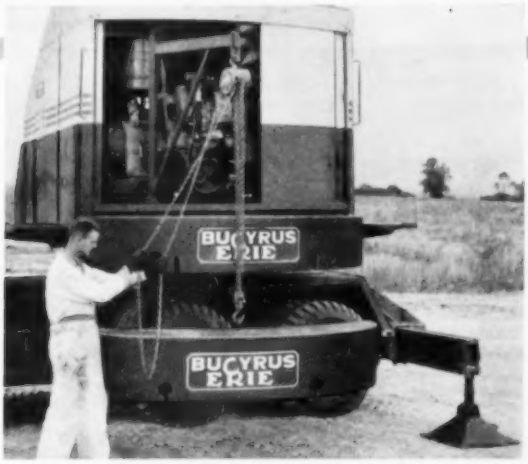
Here's why 22-B Transit Cranes

☆ **There's unusual stability** in the 22-B's wider spread outriggers. On the job, owners pull beams out to full 15-ft. spread, block them up — they're ready to work.

See your BUCYRUS ERIE® Distributor.

are YOUR BEST BUY!

compare the features!



WITH THE 22-B YOU GET

Unmatched load control!

- Power-Controlled Lowering Boom Hoist
- Power-Controlled Load Lowering (hoist line)
- Friction Swing Brake
- Conical Hook Rollers

☆ Strips fast for travel!

Counterweight drops fast! Lowering time is cut to minutes by this special jib crane. System is manually operated, lets you drop counterweight to ground or low-boy trailer.

☆ Folding booms cut move time!

You save dismantling and set-up time on moves with this hinged-section boom. Note lowered mast for minimum height during travel.

☆ Boom and mast lower to cab height!

Booms up to 75 feet with or without mast can be lowered to cab height for traveling, *without* dismantling. 22-B picks up to 130 feet of boom and jib from ground without outside assistance!

☆ High alloy steel booms

are 50% stronger than ordinary structural steel booms, yet lighter in weight. Owners lift more PAYload . . . less DEADload!

He will show you a 22-B in action!

BUCYRUS ERIE®

BUCYRUS-ERIE COMPANY
South Milwaukee, Wisconsin

TO ADVERTISE: All advertising in this section is payable in advance. Rate $1.00 per line, or $12.00 per inch of 12 lines. Minimum charge $4.00. No discounts; no commissions. Please count your copy carefully to avoid delay. Each line contains 41 characters (34 characters if all capital letters are used). Count spaces and punctuation as one character each. Allow 10 characters for box number, if blind advertisement is desired. Be sure to enclose the correct amount of money with your order. Closing date—10th of preceding month. Example: January closes December 10th.

TO INQUIRE: Be sure to address your inquiry to the advertiser by using the correct box number. Mail your letter in care of Excavating Engineer, South Milwaukee, Wisconsin. Write each advertiser a separate letter. Do not write us for name and address of advertiser. This information will not be given out. We have no information about the equipment advertised other than that shown in the advertisements themselves.

LARGE SHOVELS, CRANES, DRAGLINES — 3 YDS. & UP

HEAVY EXCAVATION EQUIPMENT
DRAGLINES, SHOVELS, CRANES,
DRILLS, TRUCKS

15-W B-E elec. drag, 215', 12-yd.
450-W B-E diesel drag, 165' w/extra 10, 12, 13 & 14-yd. buckets.
9-W B-E elec. drag, 165', 10-yd.
9-W B-E diesel drag, 165', 12-yd.
7-W B-E diesel drag, 140', 7-yd.
7400 Marion diesel drag, 175', 13-yd.
7400 Marion elec. drag, 175', 12-yd.
625 Page diesel drag, 160', 9-yd.
621-S Page diesel drag, 125', 7-yd.
71-B B-E Crane w/160' boom.
200-W B-E diesel drag, 125', 6-yd.
2400 Lima elec. drag, 130', 6-yd.
2400 Lima diesel drag, 130', 6-yd.
4300 Manitowoc drag, 120', 5-yd.
120-B B-E elec. drag, 115', 5-yd.
3900, 3500 & 3000 Manitowoc cranes.
111-M Marion drag, 100', 4-yd.
1601 Lima 4-yd. shovel/drag.
1055 P&H drag, 80', 3½-yd.
1201 Lima dragline, 85', 3-yd.
54-B B-E drag, 80', 2½-yd.
5760 Marion 26-yd. elec. shovel.
151-M Marion 7-yd. elec. shovel.
1600 P&H 6-yd. elec. shovels.
170-B B-E 6½-yd. elec. shovel.
4161 Marion 6-yd. elec. shovel.
2400 Lima 6-yd. Std. & H&L shovels.
120-B B-E 4-yd. elec. shovel.
111-M Marion 4-yd. standard shovel.
1201 Lima & 54-B B-E standard shovels.
#6 Northwest 1½-yd. standard shovel.
Model T-650 Reich drill truck mtd. rotary and down-the-hole.
Ingersoll-Rand truck mtd. & crawler mtd. Drillmasters.
Euclid trucks, dozers, attachments, etc.

FRANK SWABB EQUIPMENT CO., INC
313 Hazleton Nat'l Bank Bldg.
Hazleton, Pa.
GLadstone 5-3658

EUCLIDS
Rear, Bottom and Scrapers

12-yd. Bucyrus-Erie dragline.
9-yd. Bucyrus-Erie dragline.
6½-yd. Bucyrus-Erie shovel.
4-yd. Bucyrus-Erie shovel.
4-yd. Bucyrus-Erie dragline.
3-yd. Bucyrus-Erie shovel.
2½-yd. Bucyrus-Erie shovel and dragline.
1½-yd. Bucyrus-Erie shovel.
5-yd. Manitowoc dragline.
6-yd. Lima dragline and shovels.
Large stripping shovels.
Other equipment available, not listed above.

WILLIAM LUBRECHT, III
Construction Equipment
311 W. Diamond Ave. Hazleton, Pa.
Phone: GLadstone 5-4041 or 5-8253

SMALL SHOVELS, CRANES, DRAGLINES — UP TO 2½ YDS.

HOES & CRANES

1—Michigan C-16—¾-yd. hoe with 22" bucket, 9'9" crawlers, 20" wide, Hercules gas engine IXD #174230, machine #3797, 4 years old.
1—Osgood 200—¾-yd. hoe with 22" bucket, 11' crawlers, 22" wide, powered by Continental gas engine, machine #6285, 5 years old.
1—Lorain model TL-20 hoe with Waukesha gas engine, 6 years old, good condition.
1—Link-Belt model LS-80 crane with 50' boom, Rudomatic tagline, Buda gas, s/n 7074.
1—Link-Belt model LS-60 hoe, Buda gas engine, s/n 8128.
1—Bucyrus-Erie 10-B gasoline powered combination dragline and clamshell, 28' boom, bargain price.
1—Bucyrus-Erie 10-B gasoline powered dragline, standard cats, excellent shape, s/n 20429.
1—Bucyrus-Erie 15-B dragline with 20" treads, GMC 2-71 diesel engine, s/n 75239.

MISCELLANEOUS

1—Hoe attachment for Koehring model 303 or 304.
1—Hoe attachment for ½-yd. Osgood Invader.
1—Clark 10,000-lb. fork lift, solid tires.
1—Towmotor LT44 with pusher attachment on solid tires.
1—LeRoi 315 air compressor on 4 pneumatic tires, 7 or 8 years old.
1—Bucyrus-Erie 15-B—½-yd. shovel attachment.
1—Wiley PM215 Patchmovile portable asphalt patching unit on two pneumatic tires, complete with rotary dryer. This unit is new.
1—Ruhr M-1—½-yd. heavy-duty grapple, new.
1—Wayne 36" rider industrial vacuum pick-up sweeper, demonstrator, 2 years old.
2—GMC Jeteretes with all accessories. Excellent condition, practically new with all extra accessories.
1—Ross 6-ton pneumatic tired fork lift truck, 10' mast, 14' lift.
1—Used Kennedy-VanSaun revolving scrubber washer screen, 48" dia. x 21'0" long, in excellent shape and complete with all new parts including extra scrubber sections and new sizing screens.
1—Ford 1956—F-600 stake body truck, s/n F602N14988, air brakes, heavy-duty dump hoist, 2-speed rear and oversize motor.
1—Vermeer crawler trencher 12"—24" trench, Wisconsin 4-cylinder gas engine.

S. M. CHRISTHILF & SON, INC.
Timonium Road and Harrisburg Expressway
Timonium, Md.

Bucyrus-Erie crane-dragline-clamshell—1951; Cummins NHRS 300-hp diesel; light plant; Torcon torque converter; long crawlers 36" treads w/tapered end; 90' boom w/high "A" frame. Very good condition.
Northwest model 95 dragline, year 1952; Murphy diesel, 175" crawlers, 38" treads; 85-ft. boom w/Hendrix 2½-yd. HS dragline bucket. In extra sound condition.
Northwest model 6 hoe-clam-dragline, new Sept. '58. Murphy #20 diesel—1,750 hrs.; independent high-speed boom hoist; 65-ft. boom, mast-type gantry; Omaha 1¾-yd. perf. drag bucket; 164" crawlers—33" treads. In near new condition.
Parsons Trenchliner—model 310-2A; new Sept. '58. Cat D318 diesel—1400 hrs. Cap. 24" to 72" wide—19-ft. plus deep. Dual boom extra counterweight. Used on one job only approximately 20,000 ft. Near new condition.
Eimco model 105, front-end loader 1½-yd. rock bucket, GM diesel 132-hp, torque converter. Very good.

FRED C. GLAMM
Construction & Industrial Equipment
UP 3-1196 2751 N. 41st. St.
Milwaukee 10, Wis.

SMALL SHOVELS, CRANES, DRAGLINES — UP TO 2½ YDS.

38-B straight boom 1½-cu. yd. hoe attachment.
54-B bare [illegible] 60-ft., no point sheaves. In excellent co[illegible]
Northwest m[illegible] 25 shovel with Caterpillar diesel engine. Serial No. 9288.
Koehring model 205 shovel and hoe—¾-yd., serial No. 5262C, powered with International gas engine #17366, 1948 model.
Lorain model L-41 hoe with Waukesha gas engine. Serial No. 17852.
Unit model 1020 ¾-cu. yd. shovel, Serial No. 81256, powered with Chrysler gas engine.

CLYDE EQUIPMENT CO.
3410 First Avenue South
Seattle 4, Wash.

EXCAVATORS

1—Byers model 83-CC crane, 20-ton rating, mounted on Hendrickson crane carrier model 500E. Crane is equipped with 80' boom. Located at Phoenix.
1—Bucyrus-Erie 22-B equipped as a dragline 35' boom, Cat 318 power. A machine that has been serviced properly.
1—Bucyrus-Erie 10-BTC equipped as hoe and dragline, powered by gas engine. A clean machine.
1—Lima 604 shovel, powered by Cummins H1S diesel engine. There is a lot of production left in this machine and it is priced for a quick sale. Located at Casper.
1—Link-Belt LS71 equipped as a dragline powered by Int. UD14A engine, 45' boom with pendant suspension. A very clean machine.

ASPHALT EQUIPMENT

1—848 Barber Greene asphalt plant, equipped with feeder, bucket elevators, rotary drier, gradation unit, dust collector, pug mill, Cleaver Brooks steam boiler, G. M. model 4-71 engine, Caterpillar model D13,000 engines, also electric motors, wiring cables and panels that make this plant complete. We welcome inspections of this plant.

SCRAPERS AND BOTTOM DUMPS

3—LeTourneau Super C Tournapulls, tires range from fair to good. These machines are all capable of operating. Located at Casper.
2—Caterpillar DW20 scrapers. You will want to check the price and condition of these machines if you are in the market for scrapers.
1—Euclid model S-12 powered with 6M diesel. A near new machine.
2—Allis-Chalmers TS-300 scrapers powered by 6-71 6M diesel engines. Priced for quick sale.

TRACTOR

1—Allis-Chalmers HD-21 equipped with front and rear push blocks, 24" pads, Twin Disc torque converter. We have repaired undercarriage, engine was rebuilt by previous owner and used approximately 1,000 hours.
1—Allis-Chalmers HD-19 equipped with 26-in. grouser shoes, front pusher plate, rear pusher block. Located at Casper.
1—Euclid water wagon powered by 9FDT Euclid tractor. Tank 4,275 gallons. Complete with spray bar. Located at Boise, Idaho.

MISCELLANEOUS EQUIPMENT

1—Model 200 Parsons trencher, powered by UD9 Int. engine, 21" wide buckets, crumber and cab.
1—Woods Roadmixer model 54 powered by Chrysler industrial engine P.T.O. for D8.
1—Buda generator model P.C.D.—1879 BM-D 3091-C Novo gas starting engine connected to Westinghouse generator AC 440 volt, 390 amps, 3 phase, 60 cycle Westinghouse exciter. This unit is ready to go to work.

THE COLORADO BUILDERS, SUPPLY CO.
1534 Blake Street Denver 2, Colo.

SMALL SHOVELS, CRANES, DRAGLINES — UP TO 2½ YDS.

Bucyrus-Erie 38-B shovel 1½-yd. serial No. 101377 with Cat D13000. Very good condition $31,000

Bucyrus-Erie 38-B crane-clamshell-dragline combination, serial No. 45797 GMC 6-71 engine, 75' boom, long and wide crawlers. Very good $22,500.

Bucyrus-Erie 22-B heavy-duty crane-clam-hack-hoe combination. GMC 3-71 diesel, serial No. 119996. Less than 400 hours, like new. Combination hoe and crane $30,000. Hoe or crane only, $27,500.

Lorain 41 shovel ¾-yd. Cat D4600 engine, serial No. 14597 .....$8,900

Unit 10-20 truck crane ¾-yd., serial No. 49049. GMC 3-71 diesel mounted on Dart carrier, 30' boom. Good condition. $11,950

Insley K-12 dragline, serial No. 11289 with Buda gas engine, 35' boom, good condition $9,900

Vibro-Plus CH-30 compactor, 3.5 tons, dynamic impact 7 tons. Waukesha diesel. Demonstrator, like new $8,000

Kiesler 1½-yd. rehandling clam with counterweight type H. Like new $1,900

Esco ¾-yd. orange peel model 379. Excellent $2,125

Model 25 Bay City ½-yd. shovel, dragline, hoe combination, Cat D315 engine, tracks 10' 8" x 9' 6", with extra shovel bucket, approximately $800 worth of spare parts, good condition $14,000. With 1 front only $11,500.

American double-drum sheepsfoot roller, model AD96 with wedge type feet, 48" width drums, diameter 60" good condition. $2,000.

CONTRACTORS SUPPLY
620 East 18th St. Kansas City, Mo.
Phone: BA 1-7788

AT DALLAS

Bucyrus-Erie 15-B 40-10 dragshovel w Cat D315 diesel engine, machine #11893, motor #9S12J970, reconditioned.

Bucyrus-Erie 22-B dragline, 35' boom, Cat diesel engine, #196931, reconditioned, tractor-type tracks.

Bucyrus-Erie 22-B comb. 60-10 clamshell excavator, 45' boom, unit 79 extra counterweight, tractor-type tracks, Cat D318 diesel engine, reconditioned, #119700.

P & H ½-yd. dragline, #590860, fair condition.

Lorain model 41 dragline #14432.

Insley model K12 backhoe #55690, fair condition.

Insley model K12 dragline w 35' boom, C-9 IHC gas engine, ⅜-yd. dragline bucket, #1801, fair condition.

AT HOUSTON

1 Lorain 30 ½-yd. shovel, S/N 10198 gas engine, located at Taylor, Tex.

1 Lorain TL-20 dragline, S/N 15456, 35' boom, Cat D4400 diesel, 22" track shoes.

1 Lorain TL-25 ¾-yd. hoe, S/N 23276, Cat D315, 22" shoes.

1 Northwest 25 dragline, S/N 19079, 35' boom, 28-in. track shoes, Cat D318.

1 Bucyrus-Erie 15-B hoe attachment (straight boom), reconditioned.

1 Bucyrus-Erie unit 20A hoe equipment with ¾-yd. Esco dipper for Bucyrus-Erie 22-B (cambered boom).

1 Bucyrus-Erie 15-B dragline, S/N 86750, Cat D315, 35' boom.

1 Bucyrus-Erie 22-B (std.) hoe, S/N 119144, with Esco ¾-yd. dipper, IHC UD-525, rebuilt.

1 Bucyrus-Erie 22-B dragline, S/N 75283, IHC UD-14A, 26" track shoes, 40' boom, Hendrix ¾-yd. bucket.

1 Bucyrus-Erie 22-B, 40-10 hoe, S/N 119174, IHC UD-525 diesel, with Esco dipper, unit 76 a tractor-type mounting, unit 19A swing brake.

AT LUBBOCK

Bucyrus-Erie 22-B hoe, Cat D318 diesel engine, #73017, good condition.

BROWNING-FERRIS MACHINERY CO.

Dallas	
305 Exposition Ave.	**TA 3-8121**
Longview	
Highway 80	**PL 9-2761**
Lubbock	
2424 Clovis Rd.	**PO 5-7455**
Houston	
2619 Texas Ave.	**CA 5-3231**

Bucyrus-Erie model 22-B dragline excavator with 45' boom and Chrysler gas engine. Serial #45336. Price f.o.b. Asheville, N. C. ..$12,500

Northwest model 80-D shovel with 2½-cu. yd. Esco bucket, 30" treads, model 21 Murphy diesel engine. Serial #13119. Price f.o.b. White Haven, Pa. $26,500

E. F. CRAVEN CO.
P. O. Box 3307 515 S. Eugene St.
Greensboro, N. C.

SMALL SHOVELS, CRANES, DRAGLINES — UP TO 2½ YDS.

Manitowoc model 4500 shovel front—50-ft. boom, 32-ft. stick, 5½-yd. dipper. Excellent condition less than 500 hours use. $30,000 FOB Sacramento, Calif. Contact Clayton Reeser.

A. TEICHERT & SON, INC.
1931 Stockton Blvd.
Sacramento, Calif.

Lima model 34 crawler-mounted clam-digging-hoe combination, Buda gas engine, 35' boom, dragline fairlead, tagline reel, hoe boom with dipper. Priced to sell. Will sell with one or both attachments.

American model 375 crawler-mounted dragline-clamshell combination, Series 3-71 G.M.C. diesel engine, long crawlers, fairlead, 35' boom, excellent condition.

Unit model 357 rubber-tired wagon crane, equipped with new Chrysler Industrial engine, 25' boom, tagline reel, overhauled machinery, repainted, excellent condition.

Lorain model 55 crawler-mounted shovel, equipped with UD-18 I.H.C. diesel engine, complete with 1-yd. shovel dipper. Machinery partially overhauled. Operating condition. Make us an offer for parts or as a standby machine.

Bay City model 45 crawler-mounted dragline-clamshell machine, equipped with Cat D4600 diesel engine, long crawlers, 45' boom, tagline reel, dragline fairlead. Hoe attachment available. Price as a hoe or dragline at our yard $7,500. No trades.

Gradall model 2460. New in 1957, equipped with G.M.C. Series 3031C diesel engine on upper works. Mounted on Duplex 6 x 4 truck carrier. Included are 24" and 36" digging buckets and frost ripper. Machine in good condition and priced to sell at $18,000 at our yard. No trades on this special.

Bucyrus-Erie model 22-B crawler-mounted hoe or crane. Powered with Cat D318 diesel engine, long cats, 30" crawler treads. Machine new in late 1955. Excellent condition.

Bucyrus-Erie 22-B Transit Crane, 25-ton, equipped with G.M.C. Series 3-71 diesel engine with torque converter and two-lever governor control. Pin-connected boom up to 110' available. Mounted on Crane Carrier. Outrigger screw jacks with floats. Power steering on carrier. Demonstrator machine being offered at a considerable reduction. Call or write for more details.

Bucyrus-Erie model 11-B demonstrator 10-ton Transit Crane, equipped with up to 70' of boom. Six wheel drive carrier. Hoe equipment also available. Like new condition.

Northwest model 80-D shovel. Good working condition. Call or write for more details.

Lorain model 80-J crawler-mounted crane. Write for more details.

Model 55 Lorain crawler mounted shovel, equipped with UD-18 IHC diesel engine, complete with 1-yd. shovel dipper, machinery partially overhauled and in operating condition. Our asking price is $2,500 but make us an offer.

Hydrocrane Trade-Ins

Model H-2 Bucyrus-Erie Hydrocrane mounted on a Chevrolet truck chassis, equipped with 2-piece boom, rear outriggers, reel and bucket available. Priced to sell at $2,500 at our yard.

Model H-3 Hydrocrane, 1950, mounted on I.H.C. truck chassis, 2-piece telescopic boom, tandem outriggers, operator's cab, tagline reel, hose, ¾-yd. Hydrocrane clamshell bucket. Very good condition.

Model H-3 Hydrocrane, 1953, mounted on G.M.C. truck chassis, 2-piece telescopic boom, tandem outriggers, operator's cab, tagline reel, hose, ¾-yd. Hydrocrane clamshell bucket. Recently overhauled. Very good condition.

Model H-3 self-powered Hydrocrane, 1955, mounted on G.M.C. 6 x 6 truck chassis, 2-piece telescopic boom, operator's cab, tandem outriggers, tagline reel with hose, ¾-yd. clamshell bucket. Ford 4-cylinder Industrial engine on Hydrocrane upper. Excellent condition.

Model H-3 Hydrocrane, 1952, mounted on Ford truck chassis, equipped with 2-piece telescopic boom, operator's cab, tagline reel, ⅜-yd. clamshell bucket. Very good condition.

Model H-3 self-powered Hydrocrane, 1957, equipped with 2-piece telescopic boom, tandem outriggers, operator's cab with heater, reel and new style ¾-yd. clamshell bucket, mounted on I.H.C. S-172 truck chassis. Complete machine in like new condition at a reduced price.

Model H-3 Bucyrus-Erie self-powered Hydrocrane equipped with 3 piece boom, ¾-yd. clamshell bucket, tagline reel. Gar-Bro concrete bucket, mounted on model S-172 IHC truck chassis. Machine and truck were new in 1957. Used 450 hours. Save on a like new machine.

J. P. WAITE, INC.
3304 W. Pierce St. Milwaukee, Wis.
EV 4-1900

SMALL SHOVELS, CRANES, DRAGLINES — UP TO 2½ YDS.

Lorain model L50K, serial No. 25544, Caterpillar D318 diesel engine, combination dragline, clamshell, shovel, 75' crane boom, extended crawlers. Good condition throughout ..$15,000

Northwest model 25, serial No. 16381 hoe, ¾-yd. Amsco bucket, Caterpillar D318 diesel engine. Reconditioned and ready to work $16,750

Unit model 617, year 1954, serial No. 54125 cambered boom hoe, ⅝-yd. bucket, G.M.C. diesel engine with torque converter, extended crawlers with 22" treads. Good operating condition.

Bay City model 45, ¾-yd. hoe, serial No. 5993, Caterpillar diesel engine, standard crawlers. Good condition throughout $13,750

Lima model 802, year 1949, serial No. 5145. Caterpillar 17000 diesel engine, Kohler light plant, combination dragline and clamshell, 60' boom, extended crawlers, 36" treads. Recently completely rebuilt $39,750

Lima model 1201, year 1954, serial No. 329514. Cummins L1 diesel engine, Kohler light plant, combination dragline and clamshell, 80' boom high gantry, extended crawlers, 40" treads. Good condition $63,500

Marion model 93-M, year 1948, serial No. 85G104 2½-yd. shovel, Caterpillar D17000 diesel engine. Machine in working condition. "As is." Machine location—Buffalo, N. Y. Open to offer.

Bucyrus-Erie model 54-B 2½-yd. shovel, serial No. 22854, Buda diesel engine, standard crawlers. Machine currently working. Location northern New Jersey $15,000

Bucyrus-Erie Hydrohoe attachment for H-3 Hydrocrane complete with 18" general purpose dipper, 20" utility dipper, 12" narrow dipper and all necessary fittings. Excellent condition. Complete $750

Lorain ¾-yd. shovel front, Amsco bucket complete with dipper trip. Excellent condition throughout $1,500

Bay City 45 ¾-yd. shovel front complete with dipper trip. Good condition $1,500

BINDER MACHINERY CO.
Brighton St. Union, N. J.
MUrdock 8-0060

38-B combination drag-clam-shovel, GMC 6-71, converter; 65' boom; 2½-yd. perforated Hendrix drag bucket. Very clean, excellent condition. $42,500. Hoe attachment available, $5,500.

WEST COAST ENGINE & EQUIPMENT CO.
8350 Jackson Rd. Perkins Br.
Sacramento, Calif.

Lorain model TL-25K, serial 24928. Very good shape, with dragline, clamshell, backhoe & mats. $11,000.

Write or Call
Frank Chartier, % Charles Chartier
AuGres, Mich. Phone: UP 6-4245

1—H-EQ-1 Hoe equipment for H-3 Hydrocrane. Almost new condition. Price: $1,250—F.O.B. St. Louis, Mo.

EUCLID SALES & SERVICE INC.
5231 Manchester Ave.
St. Louis 10, Mo.

Following attachments were removed from model H-3 Hydrocrane stock: H-EQ-1 Hoe equip. w. 18" bucket, 20" utilities dipper with sidecutters, ⅜-yd. clamshell bucket, tagline reel, 3¼" heavy-duty digging ram. Net cash price complete—$2,000.

SYRACUSE SUPPLY CO.
294 Ainsley Drive
Syracuse 5, N. Y.

Unit 45 tagline reel complete with fittings, hose and guard for H-3 Hydrocrane, good condition. Price: F.O.B. Minneapolis, Minn. $150.

THE ZECO CO.
2929 University Ave., S. E.
Minneapolis 14, Minn.

H-2 magnet crane, serial #81118 mounted on International L-152, serial #76461, equipped with 24" magnet and SKW generator. Machine as is, in operating condition, price complete $5,000.

MOTT-MANBECK MACHINERY CO., INC.
Latham, N. Y.

Bucyrus-Erie H-3 (5-ton) self-powered Hydrocrane, 18 by 26' telescoping boom, powered by a Ford engine, tagline and clamshell bucket. Mounted on a Ford F600 truck, hydraulic outriggers. Reconditioned. $9,000

H. O. PENN MACHINERY CO., INC.
140th St. and East River New York 54, N. Y.

SMALL SHOVELS, CRANES, DRAGLINES — UP TO 2½ YDS.

Lorain 820, 2-yd. crane and clamshell, 65' boom, pendant suspension, 34" tracks, Rudomatic tagline, Cat D13000 diesel engine, S/N 18523. Rebuilt and guaranteed. $33,000.

Lima 802, 2-yd. shovel S/N 32618, 36" pads, air controls Cat D17000 engine with electric starter. Rebuilt and guaranteed. $30,000.

Bucyrus-Erie 15-B hoe S/N 50787, ½-yd. cap., 20" tracks, Buda gasoline engine. As inspected $7,500.

Bucyrus-Erie tunnel shovel attachment for 38-B, consisting of 15' boom, 12' handle, 1½-yd. dipper. Excellent condition. $4,500.

Fairlead attachment for Northwest No. 25. Excellent condition. $520.

Fairlead attachment for Lorain 820. Good condition. $550.

Boom section, 20' with pendants, for Bucyrus-Erie 38-B. Good condition. $590.

Bucyrus-Erie ¾-yd. clamshell bucket with teeth for H-3 Hydrocrane. 2 ram. Good condition. $550.

Bucyrus-Erie tagline reel, hose and fittings for H-3 Hydrocrane. Good condition. $225.

Allis-Chalmers HD-16G Tractor-Loader, S/N 1309, 20" triple grouser tracks, crankcase guard, track roller guards, pull hook, 3-yd. bucket with teeth. Recond. 30-day guar. $19,500.

H. O. PENN MACHINERY CO., INC.
140th St. & East River — New York 54, N. Y.

1—1948 Thew Lorain shovel model L-41 with ¾-yd. dipper. Serial No. 18216, model 3055C, serial 3A 12549. In good condition. Powered by GM diesel. Engine completely overhauled.

Service and Supply Division
LAKE SHORE, INC.
Iron Mountain, Michigan

MISCELLANEOUS EQUIPMENT

LeTourneau-Westinghouse Model "B" Tournapulls equipped with Allison Torqmatic transmissions, powered with Cummins Model NRTO-6-BI Diesel engines, 18 to 20 cubic yard BM-2 Model "B" FULLPAK 32½ ton rated load scraper, cab and lights, 27.00 x 33 tires. Very good condition and priced to sell.

Call or write for details. Inspect at Milwaukee location.

J. P. WAITE, INC.
3304 W. Pierce St. — Milwaukee, Wis.
EV 4-1900

EXCAVATORS
Increase Your Income

Convert your spare time into steady income selling most popular line of belts and buckles with customer's personal initials, first name or nickname with miniature replicas of actual clams, shovels, draglines, backhoes, scrapers, bulldozers, graders, heavy dirt removers, etc., beautifully enameled also lapels, tie clasps, key chains, money clips, and cuff links. Excellent repeat business. We furnish you with refundable complete sales kit. Really nice part-time money producing items. For full particulars, write to

HOOK-FAST SPECIALTIES, INC.
Factory—16 Eudora St. — P. O. Box 1425-E
Providence, R. I.

Asphalt Plant & Equipment

Model 847 Barber Greene continuous mix portable asphalt plant new in December, 1958. Capacity 170 tons per hour including one Cleaver Brooks oil heater, one like new B. G. 879 asphalt finisher, two 10,000-gallon insulated asphalt tanks, one 8,000 gallon fuel tank, one 1958 10-ton Buffalo-Springfield roller, one generator set. This complete plant set up with piping and other misc. equipment priced at $127,500. Located 10 miles west of Stanfield, Ariz.

Call — Wire — Write
J. P. WAITE, INC.
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MISCELLANEOUS EQUIPMENT

BIT FURNACE

Sunbeam—gas-fired with motors, blowers, feed rack & carriage. New 1956, excellent condition, $3,500. F.O.B. Evansville, Ind.

BUCYRUS-ERIE CO.
South Milwaukee, Wis. — J. E. Smart
Phone: SO 2-0900

Model 320 Cleveland wheel trencher. Like new condition. Two sets of buckets. Used very little. Call or write for more data or photos. Bargain.

J. P. WAITE, INC.
3304 W. Pierce St. — Milwaukee, Wis.
EV 4-1900

BARGAINS FOR 54-B BUCYRUS-ERIE SHOVELS

Used reconditioned dipper stick assembly, new racking, including end casting—$1,500. Used 2½-yd. reconditioned Type VH shovel dipper with bail, padlock and teeth—$2,500. Used 3-yd. Esco Mesabi shovel dipper with bail, padlock, teeth and extra door—$2,500.

CLYDE EQUIPMENT CO.
1631 N. W. Thurman St.
Portland 9, Ore.

EQUIPMENT WANTED

2½-yd. capacity dipper to fit 2-yd. Bucyrus-Erie 51-B shovel. Contact:

GREEN ISLAND CONTRACTING CORP.
594 Broadway
Watervliet, N. Y.

Notes from the Manufacturers

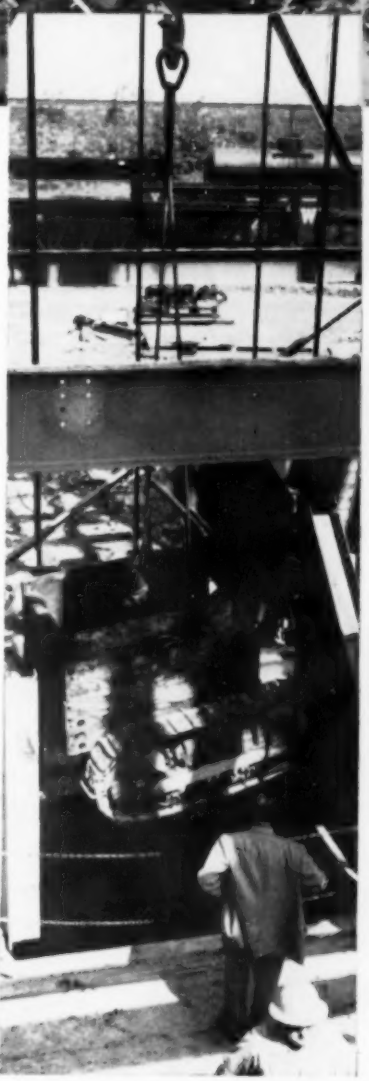
Allison Div., General Motors Corp., Indianapolis, Ind., has announced the election of Harold H. Dice, who has been general manager of the division since March 1, as a GM vice-president. A veteran of more than 30 years service with GM, Dice was Allison's assistant general manager for seven years before his March promotion. He succeeded E. B. Newill, who recently retired.

Bucyrus-Erie Co., South Milwaukee, Wis., has appointed J. V. S. Norton eastern regional sales manager. He succeeds F. Leslie Jones, who retired recently after 35 years with the firm. Norton, who was assistant manager, will continue to work out of the New York City office. An engineering graduate of Tufts University, he began his career as general foreman for the Anglo Chilean Consolidated Nitrate Corp., Tocopilla, Chile. He also served as purchasing agent and treasurer of United Electric Coal Co., Chicago, Ill., and as manager of the Tennessee Phosphate Div. of International Minerals and Chemical Co., Columbia, Tenn. Norton was a $1-a-year consultant with the Mining Division of the War Production Board, Washington, D. C., during World War II.

Curtiss-Wright Corp., South Bend Div., South Bend, Ind., has promoted Joseph Albiez to general sales manager for construction machinery. Albiez had been products sales manager and technical sales manager since Curtiss-Wright's entry into the construction machinery field, and had many years prior experience with the predecessor company.

Ingersoll-Rand Co., New York, N. Y., has appointed Joseph A. Wiendl as general sales manager. He formerly was assistant manager, and prior to that manager of the rock drill sales department. He joined Ingersoll-Rand in 1941 following graduation from Montana School of Mines.

Koehring Div., Koehring Co., Milwaukee, Wis., has appointed Pelican Machinery Co., Shreveport, as its distributor for northern Louisiana. The new distributorship will be under the same general management as Pelican Machinery Co. of New Orleans (which is Koehring's distributor for southern Louisiana), but will operate as a separate entity. Howard Elrod is in charge of the Shreveport firm. The new distributor, whose address is P. O. Box 5593, Bossier City, La., will sell and service the complete line, including crawler-mounted and rubber-mounted cranes and excavators, concrete pavers, longitudinal and transverse finishers, Dumptors and Mud-Jacks.



"18' IN ROCK SHAFTS SUNK AND CONCRETED 800 FEET IN 85 WORKING DAYS WITH EIMCO 630 IN CLEVELAND, OHIO"

Report on Joint Venture by Frazier-Davis Construction Co. and Hunkin-Conkey Construction Company.

"An Eimco 630 Excavator is loading an average excavation progress of 15 feet per working day in 18 foot diameter shafts in rock. Average mucking time is 6.25 minutes per three cubic yard bucket or 28.8 cubic yards per hour. One operator has averaged as high as 30.9 cubic yards per hour for a two week period. Part of this mucking operation is accomplished inside the concrete forms with a working diameter of only 15' 4". Average shaft progress is 9.41 feet per day, including concrete lining and utilities."

So reports A. Leavitt Crowell, Project Manager for Frazier-Davis Construction Company on two vertical shafts for International Salt Company at Whiskey Island, Cleveland, Ohio.

Shafts will go about 1,900 feet and with two Eimco 630's on the job, you may be sure the job will be completed fast and economically. Proven in service around the World, the Eimco 630 is reliable, tough and efficient.

Get all the facts! Contact the Eimco sales office or dealer nearest you, or write The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah, U.S.A.

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"

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MINING EQUIPMENT DIVISION

624 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

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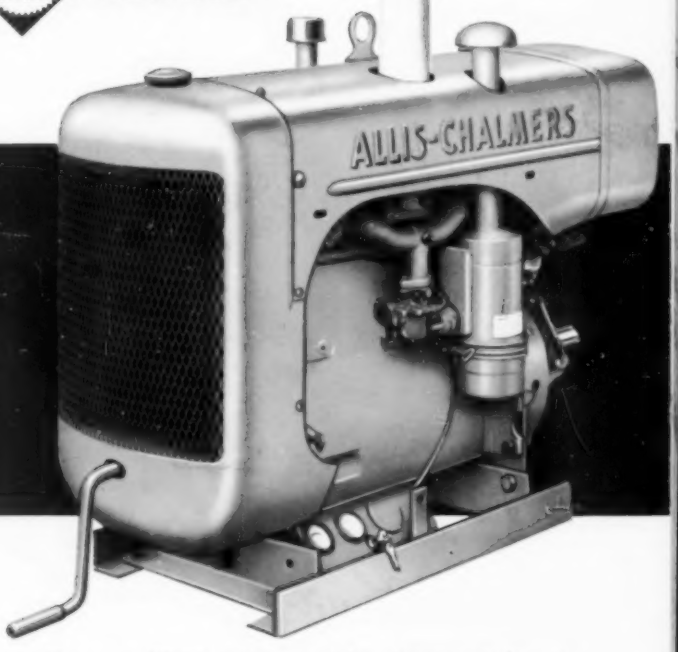
NEW

POWER-CRATER Engine joins A-C line



G-138

39 bhp at 1800 rpm

The 4-cycle, 4-cylinder G-138 is available as an engine assembly or in open or enclosed power units — equipped to fit *your* particular job.

Like other engines in the Allis-Chalmers line, the new G-138 is *tough* and *economical*. It's tough because it was built for demanding tractor service. One look at its rugged construction convinces you it will do your job *better*.

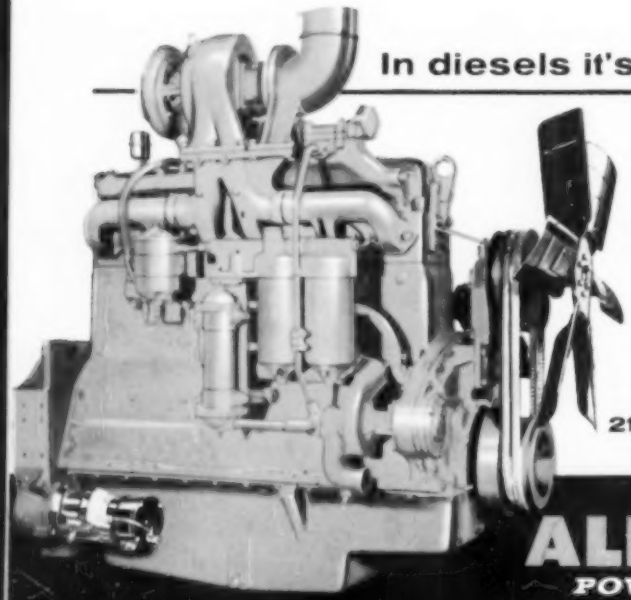
Mass production makes the G-138 economical to buy — advanced short-stroke design makes this POWER-CRATER engine economical to run. Exclusive Allis-Chalmers combustion chamber, with crater-shaped pistons, controls combustion for big-power output as well as excellent fuel economy. Advantages like wet-type cylinder liners make for low-cost, easy maintenance. Parts and service are close by at thousands of Allis-Chalmers dealers.

Put new PEP* into *your* jobs. Arrange today to have one of these tough, economical engines go to work making more money for *you*. Allis-Chalmers, Milwaukee 1, Wisconsin.

***Packages of Economical Power**

	G-138	G-149	G-226
Displacement, Cu In	138	149	226
Maximum horsepower (gasoline)	39@ 1800 rpm	45@ 2000 rpm	67@ 1800 rpm

POWER-CRATER is an Allis-Chalmers trademark



In diesels it's the PERFORMANCE PROVED 21000 and 16000

The amazing 21000 and 16000 diesels are exceeding expectations wherever they are used. The turbocharged 21000 uses *8 to 27 percent less fuel* than any other engine in its class — and has stamina to match! Torque is consistently high, acceleration is immediate. Starting is fast, too, even at sub-freezing temperatures and without starting aids. Find out more about these and other diesels in the Allis-Chalmers line — various models and sizes to 516 hp.

21000 diesel 340 hp

BE-21

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POWER FOR A GROWING WORLD